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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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VOL. X. NEW YORK, DEC. 10, 1887. No. 24.

THE decision against the Western Union Company in Massachusetts, on its corporate franchise taxes, is so important that one need not wonder to see it appealed as it now is. The company has always fought strenuously against such taxation, and is not likely now to forsake its principles.

THE fact that an ex-Lord Mayor was choked by the foul air in the London underground railroad last week ought to strengthen the demand for some better power than that of coal-consuming locomotives. The adoption of electricity on such a road may not come at once, but it is inevitable in the long run.

ELECTRIC light men still have a mission to fill when Congressmen from Texas blow out the gas in bedrooms at Washington hotels and have to be rescued by the servants. One does not know whom to pity most, the hotel proprietor who yet burns gas or the Congressman making his first acquaintance with its harmful qualities.

WE publish in this issue an interesting note on work done in a large English colliery by electric motors. The results obtained are very satisfactory, and have led to an increase in the plant. In America there is promise of similar good mine work, additional to that already done in electric locomotion at Lykens Valley, and a number of plants will shortly be in operation. We expect to see, in this connection, some notable examples of long-distance power transmission.

ENGINE regulation is so intimately connected with electrical applications that many of our readers will be interested in the latest developments in that domain, as brought out by Mr. Ball in a paper read before the American Society of Mechanical Engineers. While Mr. Ball's original method of dynamometric governing undoubtedly approaches very near to the results which theory indicates, the recent addition gives a wider scope of effectiveness and permits of regulation even with a considerable variation in steam pressure.

AN electrical phenomenon, though well known, when brought out prominently as the basis of a new instrument is sure to direct efforts in that particular direction and to lead to the publication of prior work. The coulomb meter of Prof. Forbes, depending upon the heating action of the current, is no exception to this rule, and in another column will be found a description of several instruments, which, though differing in construction from that of Prof. Forbes, utilize the same well known principle. We may now expect to see this principle applied in a variety of forms, and many of our readers will, without effort, be able to conceive of ways in which it can be applied.

WE do not know on just what basis the opponents of the American Bell Company are building their hopes, during the present delay in rendering the Supreme Court decision, as to the "breaking" of the Bell patent, but that optimistic sentiments do prevail is not to be gainsaid. It is not our business to mar anybody's joy, but we would like to ask whether, if some of these opposition telephone stocks were to be worth all that is claimed, in case of a decision adverse to the Bell patent, the stock of the company to-day in possession of the field and entrenched in all kinds of ways, would not be worth a good deal more even than it now is?

THE uses of train telegraphy continue to manifest themselves. One of the latest brought to notice was that in which the system served to bring prompt medical assistance to a lady taken ill on board a Lehigh Valley train. The operator sent a message, bringing a doctor to the next station, and the sick person was immediately tended and relieved. The same system was also employed to call a carriage to the depot for the lady on her arrival, and to summon a locomotive to take the doctor home. That all this could be done easily and effectively by means of telegraphy from a moving train shows that the traveling public has gained an appliance of no mean value for greater comfort and safety.

OUR article in last week's issue describing Lieut. Patten's electric target recorder is rendered most timely and pertinent by the announcment this week of the severe punishment meted out to some of the enlisted men in the U. S. Army for falsifying the scores of marksmen. The 24th U. S. Infantry Regiment, to which the condemned men belonged, consists of colored troops, whose marksmanship has been unusually high in comparison with that of other regiments in the service. The cause of this is now evident, and though a strict supervision may do much to remedy the evil, which is said to exist to quite a large extent, the application of an electric recorder in sight of the officer in charge will make fraudulent returns almost impossible.

So well pleased is Scranton with its electric road that another is being added, while all through Pennsylvania the success and economy of the road have set on foot dozens of electric railway enterprises, many of which will soon be carried out. Down South a number of electric railway plans are maturing, and out West there are indications of great activity in the same line of work. California is a particularly inviting field, and promises soon to have more electric roads than any other State. Coming nearer home, we find Brooklyn with an electric road, six miles long, just gone into operation, and with plans made, or agitation going on, for half a dozen more. Altogether the outlook in this department is very bright.

WHAT might have been a very interesting lawsuit regarding the validity of the Brush patent for the compound winding of dynamos has been settled in England by compromise. The Brush Electric Light Corporation, it will be remembered, had brought suit against Messrs. Crompton & Company, on this patent, and the latter firm brought a cross action on the Crompton-Kapp patent. The suits have been settled by Messrs. Crompton & Company taking out a license for the use of the Brush patent, while the owners of the latter have acquired the Crompton-Kapp patent. The Brush patent for compound winding, therefore, still stands unassailed in England. If compound winding were more employed in this country we should, no doubt, also be the witnesses of the legal battle which is the inevitable accompaniment here of prominent electrical inventions at present.

TIME has not been lost in taking steps to organize the new opposition telegraph company. This one is to secure a charter in Massachusetts, string copper wires on light poles, do a business between New York and San Francisco, and then—. As a rule, such movements have our support and sympathy, not because they are started by "oppositions," but because they represent, as in the case of the Baltimore & Ohio Company, active and honest competition; but in the present instance it is not clear to us that the new company expects to do much fighting on its modest capital of $3,000,000. If it is started simply to be bought out, that is not a matter of interest to the public. Perhaps it will be well to wait and see what the plans and actions of the Postal Automatic Company really are. Meantime Congress is threatened with an avalanche of government telegraph bills, embodying all kinds of propositions, and the indications are that the subject will be more vigorously debated in both the Senate and the House than ever before.

IN the communication read before the London Physical Society, of which we give an abstract, Mr. T. H. Blakesley draws attention to an interesting phenomenon in the application of alternate current motors. It was shown that by the use of a condenser placed across the terminals of the motor a greater current could be passed through it than that passing through the line or generator. This seems probable when we consider that a condenser so placed would neutralize the action of self-induction in the motor, in which the induced currents tend to weaken the direct. Thus, by the removal or neutralization of the former, an increased current is obtained. The action seems to be quite analogous to that which is taken advantage of in the application of the condenser to the induction coil and in electromagnets to reduce their sluggishness and remove the sparking on the rupture of the circuit. Mr. Kapp also draws attention to the fact that theory points out that an alternating current motor requires a greater weight per horse-power developed than the continuous current motor.

LAST week witnessed the close of the American Institute Electrical Exhibition, which had for nine weeks given the public an opportunity of becoming acquainted with some of the most promising modern applications of electricity. The electric motor fully demonstrated at the exhibition that its claim for public recognition was well founded. The work which the motor performed included almost anything from driving sewing machines to propelling full sized street cars and passenger elevators. In other branches decided progress was shown, and the fascination of Prof. Thomson's electric welding process will long be remembered by the crowds that witnessed the operation daily. The public also had an opportunity of observing two types of facsimile telegraphs, that of Mr. Edison and that of the Writing Telegraph Company, and the operation of a cable recorder. The Historical Exhibit of the New York Electrical Society also contained a large number of valuable and interesting relics, and its completeness was largely due to the hearty exertions and excellent judgment of Mr. James Hamblet and Dr. P. H. Vander Weyde. Mr. John M. Pendleton, the president, and the members of the society, deserve credit for the success which they have made of the exhibition, and have our congratulations on the stimulus they have given to the demand for electrical applications in this city and region.

THE gauge chart compiled by Mr. S. S. Wheeler, and published as a supplement to THE ELECTRICAL WORLD, may be said to be the only present available basis for a thorough discussion and comparison of the relative merits of the various gauges. Its appearance has brought forth more than one valuable expression of opinion. Among them is that of Lieut. J. B. Murdock, who treats the question in an eminently fair manner in an article appearing on another page. He shows that for electrical purposes a gauge based on a unit of sectional area such as the Edison gauge is exceedingly convenient, allowing of the calculation of nearly all factors in electrical work with the greatest ease, without reference to any tables whatever. It cannot be denied that this property of the gauge is one which essentially fits it for use among those who are required to calculate frequently the various problems in connection with the use of copper wire in electrical work. Lieut. Murdock compares this gauge with that adopted by the National Electrical Light Association, and shows wherein he regards it as superior to the latter in some respects. At the discussion of the gauge chart before the American Society of Civil Engineers, Mr. Wheeler himself expressed himself in favor of the Brown & Sharpe gauge, while another speaker said that no difficulty was experienced with the use of the micrometer among the men working in his establishment. It seems that as long as no universal, or at least national, gauge is adopted, the one best suited to his individual requirements will be employed by each user of wire.

A Simple Wire Gauge.

BY LIEUT. J. B. MURDOCK, U. S. N.

It would seem that there was nothing new to be said on the subject of wire gauges, but the article by Mr. Wheeler in THE ELECTRICAL WORLD of Nov. 12, although extremely valuable from the data compiled, suggests several vital points which seem to require consideration before any order can be brought out of the existing chaos.

The first of these is, Should the sizes of wire be based on the wants of the consumer, or on the convenience of manufacture? It is obvious that the former should take precedence, due attention of course being paid the latter. The determination of a gauge simply from the choice of convenient reductions in a draw plate is one of the principal causes of the present dissatisfaction.

Second: The wants of the electrical consumer are thought to be varied, and the statement is frequently made that the electric light engineer, the telegrapher and telephonist all need different gauges. They may, at present, but all electrical calculations, being largely based on resistance, could be readily met if the gauge were based on the idea of area of cross section.

Third: Several of the gauges in Mr. Wheeler's table are based on area, but their practical usefulness is limited by a system of arbitrary numbering. Facility of calculation, as well for the engineer as for the lineman, is wonderfully promoted by the plan adopted in the new Edison gauge, of having the gauge number denote in itself the area and, consequently, the relative resistance of the wire. It is noticeable that the resistance of No. 10 in the Edison gauge is almost exactly one legal ohm per thousand feet for commercial copper of 96 per cent. conductivity at 32° F. The best iron wire of the same size may be taken at six ohms per thousand feet at 32°. With this one fact as a starting point, calculations of approximate resistance, fall of potential and current density become wonderfully simplified. Examples are appended.

The advantage of this system of numbering is somewhat akin to that of the metric system in physical work, viz., the elimination of arbitrary values which necessitate constant reference to tables, and the substitution therefor of a simple system of ratios, all dependent on one constant. This great advantage does not seem to be appreciated, and the Edison gauge is commonly regarded only as another mass of irrelevant and disconnected figures to swell the already burdened wire gauge discussion, its chief advantage being perhaps stated to be that its values when plotted give a geometrical curve!

Fourth: Is there any existing necessity for using the same gauge for wires and plates? If not, the fact that such a custom is in use ought not to be allowed to exercise influence on the question of a wire gauge.

If the gauge number denoted the area of cross section, only such sizes as experience has shown to be necessary would have to be manufactured. The system is flexible, and not only admits of new numbers being given to represent wire now in use; but if new sizes should at any time become necessary, they could be interpolated by giving each, not an arbitrary gauge number, but one representing the area of its cross section to the nearest unit adopted. To avoid excessively cumbersome gauge numbers it might be advisable to have a smaller unit of area adopted for the small sizes, but this unit should have a simple ratio to that for large sizes. Thus, referring to the Edison gauge, No. 1 corresponds quite closely to No. 20 B. & S., and below that size the numbers might show the area not in thousands of circular units, but in circular units themselves, affixing a letter to distinguish these numbers from the larger sizes. Thus No. 30 B. & S., with an area of 100½ circular units, would be quite accurately represented by the number 100 M. This number shows the area, and from it the diameter in $\frac{1}{100}$ of an inch and the resistance of commercial copper, one hundred legal ohms per thousand feet, are obtained directly.

The committee of the National Electric Light Association showed themselves to be in conformity with the spirit of progress in recommending a metric system, but, as their gauge is based on diameter, the common calculations are complicated by the necessity of squaring or of extracting the square root. A metric gauge in which the gauge number denotes the area would be a practical working system which would admit of international use. To sum up: Are not the advantages arising from having the gauge number a direct indication of the cross section of the wire of sufficient importance to be considered, as against mere mechanical conveniences of manufacture, as scientific bases of wire reduction?

EXAMPLES.

Starting point: 1,000 feet No. 10 Edison gauge, commercial copper of 96 per cent. conductivity, has a resistance of one legal ohm at 32° F. The gauge number denotes the area of cross section in thousands of circular mils.

1. What is the resistance of 500 feet No. 150 E. S. G.?

Answer: 1,000 feet has a resistance of $\frac{10}{150}$ ohm, hence 500 feet has a resistance of $\frac{1}{30}$ ohm.

2. What is the fall of potential in 400 feet No. 60 E. S. G. with a current of 70 ampères?

Answer; Resistance $= \frac{400}{1{,}000} \times \frac{10}{60} = \frac{1}{15}$ ohm.

$$\text{Fall of potential} = \frac{1}{15} \times 70 = \frac{70}{15} \text{ or } 4\tfrac{2}{3} \text{ volts.}$$

3. What current can be carried by No. 120 E. S. G. on the basis of 1,000 ampères per square inch?

Answer: 1,000 ampères per square inch is equal to 785.4 ampères per circular inch, or No. 1,000 E. S. G.

$$\therefore \text{No. 120 carries } \frac{120}{1{,}000} \times 785.4 = 94.25 \text{ ampères.}$$

4. What size of wire is necessary to carry a current of 120 ampères a distance of 850 feet with a drop of eight volts?

Answer: The resistance of the wire is $\frac{8}{120}$ ohms for 850 feet and $\frac{8}{120} \times \frac{1{,}000}{850} = \frac{20}{255}$ ohm per 1,000 feet.

$$\therefore \text{Size of wire} = \frac{10}{\frac{20}{255}} = 128, \text{ or, approximately, No. 130 E. S. G.}$$

Remembering that the weight of one foot of copper wire No. 10 E. S. G. is very nearly $\frac{1}{100}$ pound, problems of length and weight are also readily solved.

5. What is the weight of 125 feet of No. 300 E. S. G.?

Answer: $\frac{3}{100} \times \frac{300}{10} \times 125 = \frac{125}{10} \times 9 = 112\frac{1}{2}$ pounds.

6. Required the length of 46 pounds of No. 80 E. S. G.

Answer: $\frac{46}{\frac{3}{100}} \times \frac{10}{80} = 191$ feet.

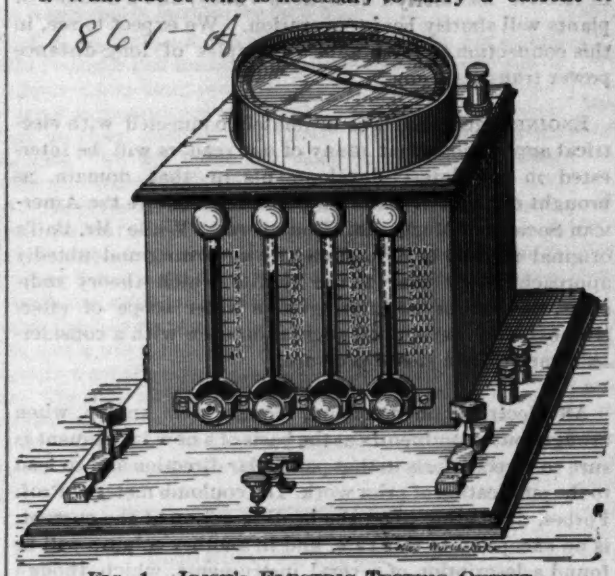


FIG. 1.—IRISH'S ELECTRIC TESTING OUTFIT.

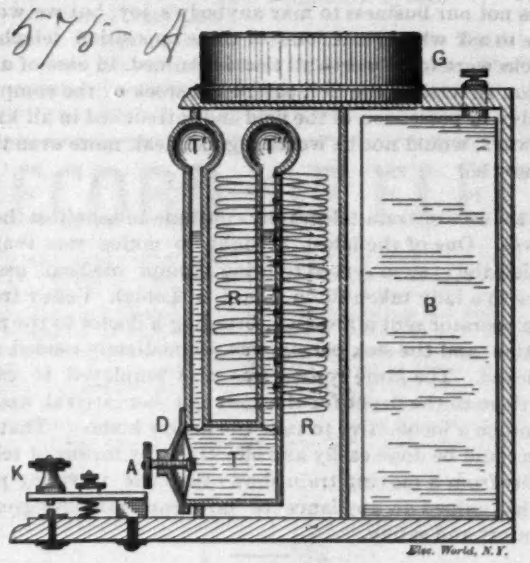


FIG. 2.—IRISH'S ELECTRIC TESTING OUTFIT.

Irish's Electric Testing Outfit.

Hitherto it has been customary to employ for resistance measurements and testing generally the ordinary B. A. unit peg box, or the wire rheostat. There are several objections to the use of pegs in the former, as they are apt to be lost or mislaid; again they become more or less greasy by handling and frequently make unreliable contact unless the greatest care is taken. The rheostat is simple and convenient in action, but is somewhat troublesome and its application is limited. In the apparatus illustrated in the accompanying engravings Mr. W. E. Irish, of the Globe Electric Company, of Cleveland, O., has sought to remove all these objections.

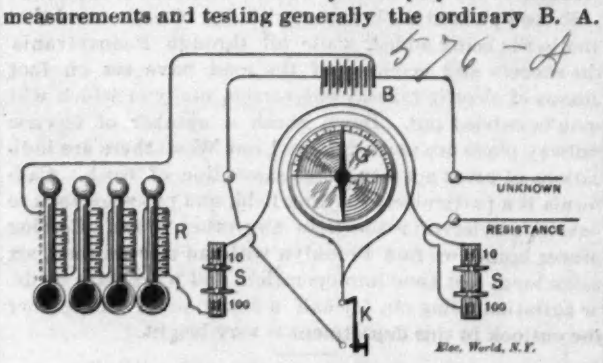


FIG. 3.—IRISH'S ELECTRIC TESTING OUTFIT.

He combines the Wheatstone bridge, a set of B. A. units, a delicate differential galvanometer, and a battery; in fact, everything requisite for testing. One milled head thumb-screw is employed in place of ten pegs and any portion of the resistance coils may be introduced into or cut out of, the circuit by the simple turning of one or more of the four milled head thumb screws which project from the front of the apparatus shown in perspective in Fig. 1 under their respective indicating columns. By turning one of these screws back ever so slightly the mercury which the tubes contain is relieved from pressure and will fall in the respective columns in proportion to the movement of the screw and introduce resistance, the amount of which in ohms is indicated on the scale similar to temperature on a mercury thermometer. This is clearly shown in Fig. 2, which represents a section of the apparatus.

As will be seen it consists of a short glass tube *T* sealed at one end and having projecting from it two other tubes *T'T''*, smaller in diameter, and terminating in bulbs which also close them. The other end of the tube *T* is closed with a flexible diaphragm *D* after the bulbs have been filled with mercury. Crossing this diaphragm and secured firmly to the end of the tube is a bridge supporting in its centre a thumb screw *A*, which is employed to depress or extend the diaphragm, thereby causing the mercury to rise or fall in the smaller tubes according to the direction in which the screw is turned.

The front tube *T'* is employed simply to indicate the amount of resistance introduced through the fall of the mercury in the second small tube *T''*, into the sides of which the ends of the resistance wires *RR* are sealed, and which are thus exposed to the mercury within. In the normal position of the apparatus, the mercury will thus cover all the ends of the resistance coils, and therefore there will be no perceptible resistance in the circuit, it being simply closed through the mercury. It can be easily understood that when the two extreme ends of one of these sets of resistance coils are joined in an electrical circuit, as shown in Fig. 3, the fall of the mercury in the column will introduce resistance step by step in proportion to its fall.

In the apparatus illustrated there are four such pairs of indicating and resistance columns, representing an aggregate of 11,110 ohms. The range of the apparatus is not, however, limited to this resistance, as by means of the galvanometer *G* and shunts *S S* a resistance up to 1,111,000 ohms may be reached. Each of the four columns has ten resistance coils, the first ranging from 1 to 10 ohms, the second column from 10 to 100, the third column from 100 to 1,000, and the fourth and last from 1,000 to 10,000. The mercury is shown in the indicating columns to represent a resistance of 6,431 oms.

The coils of the galvanometer *G* are of German silver wire wound differentially; that is, the two coils of equal length and resistance are wound side by side in opposite directions and arranged so that the current divides equally between them, and the influence of one coil on the needle is counterbalanced by the influence of the other coil, which acts upon the needle so as to tend to deflect it in the opposite direction and with the same force as the first; hence, when the current is alike in each the needle remains uninfluenced.

In testing, the known resistance is put in circuit with one, and the unknown with the other coil. The unknown being higher than the known resistance, which, on commencing to make a test, is *nil*, will cause the needle to be deflected. The thumb screws are then turned until the needle is brought back to zero or balanced by the introduction, step by step, of the known resistance, which will be equal to the unknown. Shunts *S S* of $\frac{1}{9}$ and $\frac{1}{99}$ of the resistance of the galvanometer coils are introduced into each to vary the sensibility of the galvanometer and give increased range, enabling measurements to be made 10 or 100 times greater or less than the capacity of the resistance coils alone.

A modified Daniell battery forms part of the apparatus. It is placed at the back within the case and partly under the galvanometer, Fig. 2. In this instrument all the connections, excepting of course with the unknown resistance and ground, are permanently made and complete, ready for making a resistance test.

The instrument was specially designed to be put in the hands of those not familiar with the methods heretofore largely employed, and which are apt to be forgotten with little practice. With the present instrument but two connections have to be made, and these without possibility of making an error. Its use is said to effect a great saving in time in determining resistances, as compared with the Wheatstone bridge method.

Bruce's Balloon Signals in Belgium.

On the 26th ult. some trials of Mr. E. Bruce's system of transmitting military signals at night took place at Antwerp, before General Pontus, the Belgian War Minister, and several distinguished officers of the Belgian army. Our readers, says the London *Electrician*, will probably recollect that this arrangement (which has been adopted in the English army) consists merely of putting some incandescent lamps inside a small balloon which is allowed

to float at a moderate height, and then flashing signals by means of a Morse key with carbon contacts. The system is so simple and practically certain in its operation that it scarcely needs any preliminary trial, and we need hardly

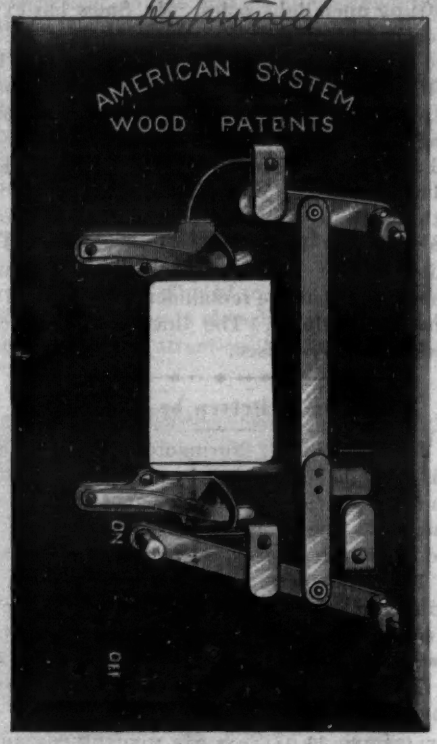


FIG. 3.—AMERICAN LAMP CUT-OUT.

say that the rehearsal at Antwerp gave perfect satisfaction to all concerned. The signals were easily read at a distance of 3,000 metres, but observers were also stationed on the cathedral tower at Mechlin, and on the church at Wilrysch—distant about twenty miles. Their reports had not been published, but owing to the fact that the balloon only attained a height of 100 metres, it was not thought probable that the signals could have been seen so far. There is little doubt that the arrangement will become common in the European armies. The batteries used on this occasion were supplied by the Electrical Power Storage Company.

Wood's New Electric Light Apparatus.

During the last few months Mr. J. J. Wood, the electrician of the American Electrical Manufacturing Company, has been engaged in the work of simplifying and making more effective the apparatus which is associated with his name, and the result has been the production of a number of novel devices embodying many interesting features.

One of the most important equipments for street lighting is a suitable post upon which to suspend the lamp, and extend it out in the centre of the street at intersections. The light is thus equally distributed in the four directions, which would not be the case where the lamp is mounted directly on the top of the post. In designing a mast arm by which the lamp can be suspended, Mr. Wood has had in view principally the convenience of handling by the lamp trimmer, while at the same time making the device so that the least time shall be occupied in getting at the lamp. The entire arrangement is illustrated in our engraving, Fig. 1. Here, as will be seen, two braces support the horizontal mast arm pivoted near the centre, so that it can be swung in a vertical plane by means of the rod and handle attached to its inner end near the post. The lamp is of sufficient weight to turn the outer end of the pivoted arm a little below the horizontal, the motion of the arm being limited by a stop on the post. The lamp, it will be seen, is hung on a hook which is attached to a trolley that runs on a rod attached to the mast arm. The lineman, after mounting to the top of the steps upon the post, catches hold of the handle shown, and by hauling down tilts the pivoted arm until its inner end near the post is brought below the horizontal. The trolley holding the lamp is then on an inclined plane, and the consequence is that the lamp and trolley are set running in towards the post, stopping close to the latter. In this position the trimmer has full control of the lamp, and can re-carbon and inspect it. When he has finished, the trimmer pushes up the rod provided with a handle, when, the inclination of the mast arm being in the opposite direction, the lamp runs out towards the further end again, and remains in that position.

It is evident that a tilting of only a very small angle will set the lamp in motion in either direction, and any increased angle that might tend to give the running lamp such a velocity as to endanger its safety when it arrives at the end of its journey must be avoided. In order to prevent this Mr. Wood has applied a very ingenious device, by means of which the speed of the lamp in either direction cannot exceed a certain safe limit. This device is shown in Fig. 2. It will be seen that the hook on the trolley from which the lamp is suspended is provided with a contrivance which, under certain conditions, acts as a brake upon the trolley wheels. When the mast arm is in a horizontal position, the hook hanging vertically keeps the brake *a a' b b'* out of contact with the wheels, and

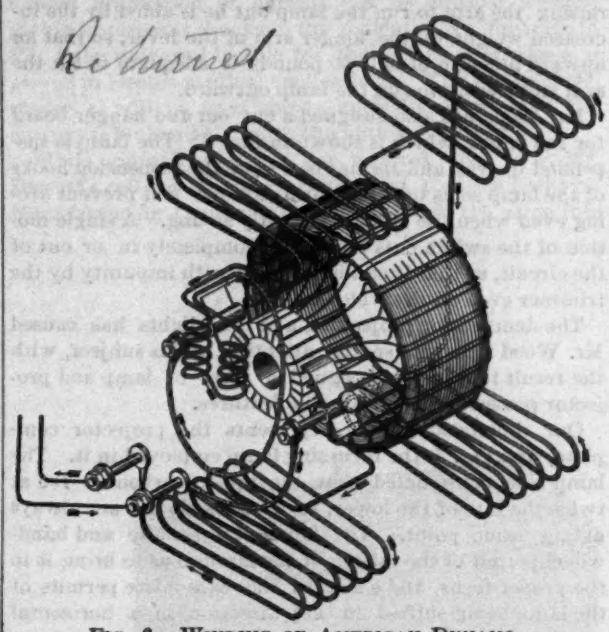
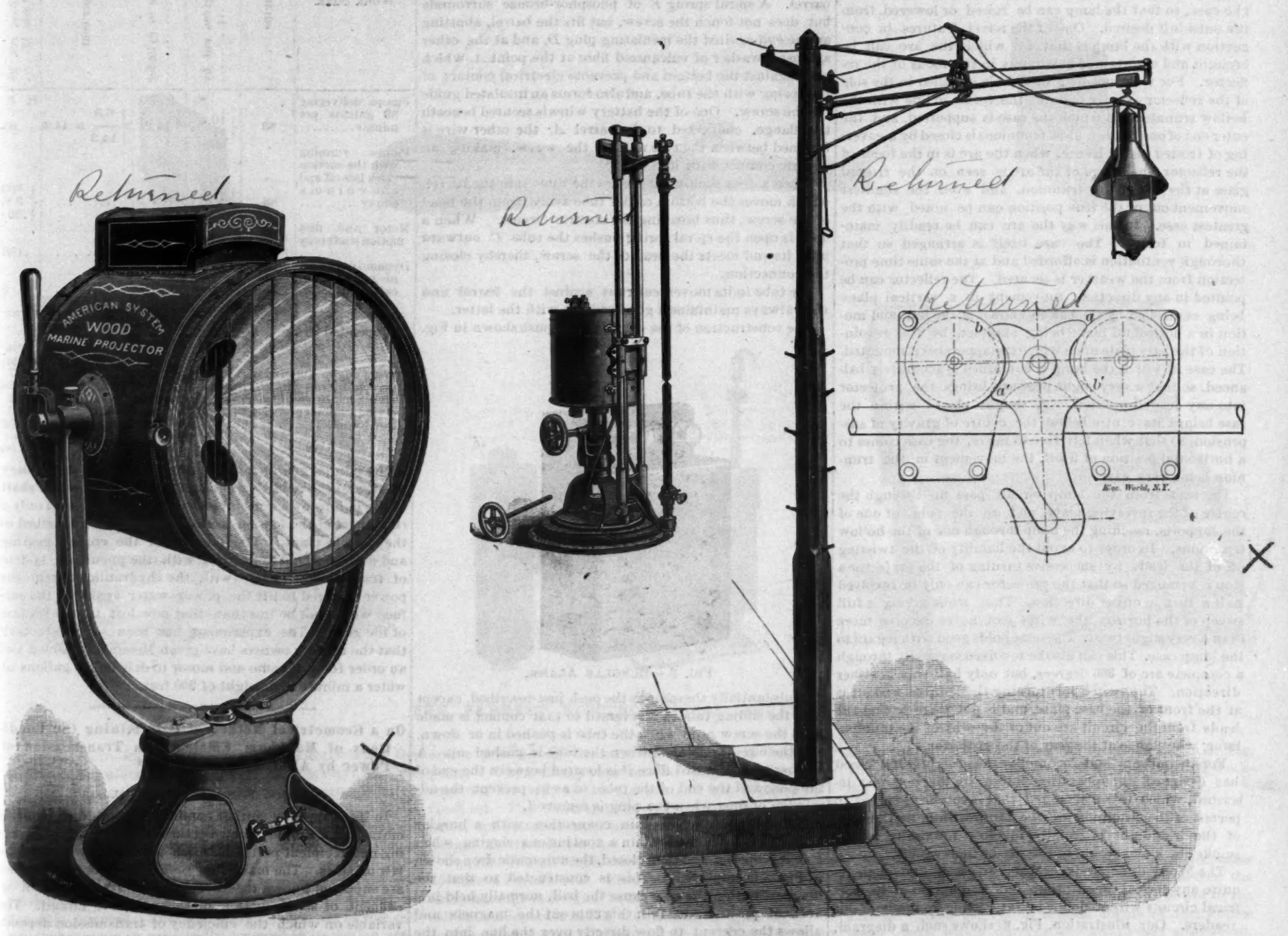


FIG. 6.—WINDING OF AMERICAN DYNAMO.

even a small angle of inclination, such as that shown in the diagram, leaves the brake almost in contact; but this angle is sufficient to set the lamp in motion. But if the mast be given any greater inclination than the angle shown, the brake will come into contact with the wheels; in one direction the points *a a'* coming in contact, and in the other the points *b b'*. Hence it will be observed that by no carelessness on the part of the trimmer can the lamp be given a greater speed than that which will insure its safety.

It will also be noted that the hook upon which the lamp is suspended is pivoted on a spindle smaller in diameter



FIGS. 4, 5, 1 AND 2.—WOOD (AMERICAN) FOCUSSING LAMP AND MAST ARM.

than the hole in the hook itself. Thus all friction at that point is avoided so that the brake cannot be applied unless under the conditions for which it is intended.

It will be observed that the mast arm is pivoted some distance out of the centre, the longer arm of the lever thus formed being on the outside. Thus the trimmer, when drawing down the inner end of the mast arm to run the the lamp in, exerts a downward pressure of about 50 pounds, which he can easily exert in that way. But when raising the arm to run the lamp out he is aided by the increased weight of the longer arm of the lever, so that an upward pressure of only 30 pounds is adequate to tilt the arm sufficiently to run the lamp outward.

Mr. Wood has also designed a cut out and hanger board for the lamps, which is shown in Fig. 3. The lamp is suspended in eyes, and springs bear upon the suspension hooks of the lamp so as to insure firm contact and prevent arcing even when the lamp is violently swung. A single motion of the switch cuts the lamp completely in or out of the circuit, so that it can be handled with impunity by the trimmer even on the wettest day.

The demand for projectors and head-lights has caused Mr. Wood to devote special attention to this subject, with the result that he has designed a form of lamp and projector possessing very valuable features.

Our illustration, Fig. 4, represents the projector complete, and Fig. 5 the focussing lamp employed in it. The lamp is so constructed that the upper carbon is fed at twice the rate of the lower, so as to keep the arc always at the same point. The horizontal spindle and hand-wheel permit of the raising of the lamp so as to bring it to the proper focus, and a slot in the base plate permits of the lamp being shifted in any direction in a horizontal plane, so that it can be brought completely in the focus of the reflector. This lamp is placed entirely within the projector, and is thus free from all disturbing causes.

The case of the projector need not be opened to regulate the position of the focus, a spindle connected by a universal joint to the one above mentioned passing through the case, so that the lamp can be raised or lowered from the outside if desired. One of the novel features in connection with the lamp is that by which the arc can be brought and maintained accurately in the focus of the reflector. For this purpose a small hole is drilled in the side of the reflector exactly opposite the focus in line with the hollow trunnions on which the case is supported, and the outer end of one of the hollow trunnions is closed by a covering of frosted glass. Hence, when the arc is in the focus of the reflector, the image of the arc is seen on the frosted glass at the end of the trunnion, and even the slightest movement out of the true position can be noted with the greatest ease. In this way the arc can be readily maintained in focus. The case itself is arranged so that thorough ventilation is afforded and at the same time protection from the weather is secured. The reflector can be pointed in any direction; movement in a vertical plane being controlled by the handle shown at the left, and motion in a horizontal plane being obtained by the revolution of the base plate upon which the apparatus is mounted. The case in which the lamp is contained is accurately balanced, so that a very slight pressure brings the projector into any desired position. A weight placed within the case brings its centre below the centre of gravity of suspension, so that when left free to move, the case comes to a horizontal position of itself, the movement in the trunnion being very easy.

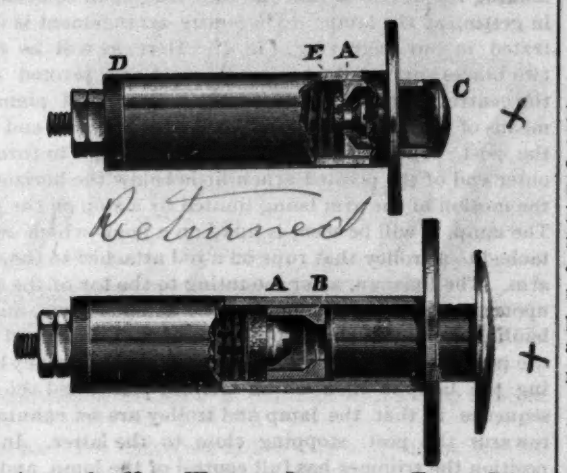
The leads from the lamp circuit pass up through the centre of the revolving plate, and up the side of one of the supports, reaching the lamp through one of the hollow trunnions. In order to avoid the liability of the twisting off of the leads by successive turning of the projector a stop is arranged so that the projector can only be revolved half a turn in either direction. Thus while giving a full sweep of the horizon the wires can never receive more than a very slight twist. The same holds good with regard to the lamp case. This can also be revolved vertically through a complete arc of 360 degrees, but only half way in either direction. The switch for turning the lamp on and off is at the front of the base plate, and is put there so that the leads from the circuit are out of the way of the manipulator, who stands at the rear of the projector.

For steamboats and locomotive head-lights Mr. Wood has designed an apparatus similar to the one just described, which is so arranged that it can be revolved to permit of the trimming of the lamp within, as the back of the head-light is usually in close proximity to the smoke-stack and would ordinarily be inaccessible.

The Wood dynamo is probably too well known to require any special description, but a diagram of its electrical circuits will no doubt be interesting to many of our readers. Our illustration, Fig. 6, shows such a diagram, which illustrates the method of winding both of the armature and field, and is so clear as to require no special explanation. We may, nevertheless, point out one fact in connection with the winding of the field. As usually wound, the meeting points of the two branches of a series dynamo field constitute the binding post to which the outer circuit is connected; hence any two points in opposite fields are at almost the maximum difference of potential generated by the machine, and if a "ground" occurs anywhere on the machine the attendant touching one of the brushes and the iron of the machine is apt to get a shock. With the present method of winding, as shown, no point in the field can be at a greater difference of potential than that due to the mere resistance of the field itself, which is trifling, and hence all danger from grounding in the machine is avoided.

Some Novel Alarm Apparatus.

Among the novelties lately designed by Messrs. Shaw & Geary, of Philadelphia, is an electric door spring, which is shown in part section, full size, in the accompanying illustration, Fig. 1. As will be seen, a brass tube *C* fits into one end and projects from the barrel ¼ of an inch. The tube is made with closed ends, the sides being longitudinally slotted, forming springs which bear elastically against the inner sides of the barrel *A*. A brass screw with beveled head on its under side rests normally against a correspondingly tapered bottom in the tube *C*. The screw passes through a threaded opening in an insulated plug of



FIGS. 1 AND 2.—NEW WINDOW SPRING AND FLOOR PUSH.

hard rubber, which is screwed into the opposite end of the barrel. A spiral spring *E* of phosphor-bronze surrounds but does not touch the screw, but fits the barrel, abutting at one end against the insulating plug *D*, and at the other against a washer of vulcanized fibre at the point *A*, which rests against the bottom and prevents electrical contact of the spring with the tube, and also forms an insulated guide for the screw. One of the battery wires is secured beneath the flange, connected to the barrel *A;* the other wire is fastened between the two nuts on the screw, making an electric contact with it.

When a door is closed it pushes the tube into the barrel, which moves the bottom of the tube away from the head of the screw, thus breaking the electric circuit. When a door is open the spiral spring pushes the tube *C* outward until its end meets the head of the screw, thereby closing the connection.

The tube in its movement rubs against the barrel and thus always maintains a good contact with the latter.

The construction of the electric floor push shown in Fig.

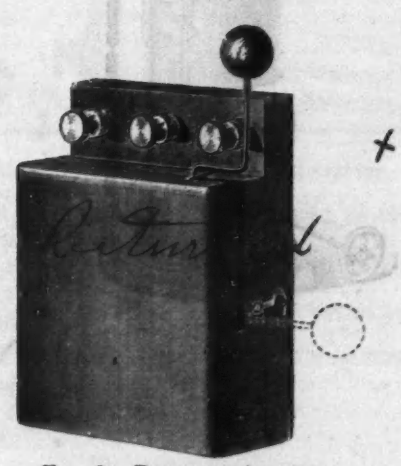


FIG. 3.—BURGLAR ALARM.

2 is substantially the same as the push just described, except that the sliding tube *A* is reversed so that contact is made with the screw head when the tube is pushed in or down, and the circuit is broken when the tube is pushed up. A washer of vulcanized fibre *B* is located between the end of the plug and the end of the tube, so as to prevent the admission of dust when the plug is removed.

The door push is placed in connection with a burglar alarm, but in order to obtain a continuous ringing when a door is opened and then closed, the automatic drop shown in Fig. 3 is employed. This is constructed so that the magnets within the case cause the ball, normally held in a vertical position, to fall; this cuts out the magnets and allows the current to flow directly over the line into the bell, which continues to ring until the ball is raised again.

The Postal Automatic Telegraph Company.

A movement has already been set on foot to start a new telegraph company, to compete with the Western Union Company—and then to sell out, if precedent be followed. Mr. Chester Snow, who is the prime mover of the scheme, has selected for the name of his corporation "The Automatic Postal Telegraph Company." He proposes to start off with a capital of $20,000,000, and incorporates in Massachusetts. According to his prospectus the line can be constructed at a much less expense than ordinary telegraph lines, and the automatic system will enable the managers to reduce the operating cost to the minimum. The intention is to use copper wire, which will be strung upon light poles. Mr. Snow has expressed himself as confident that the Massachusetts Legislature will give him a charter, and he thinks there will be little trouble in securing the right of way in the various States through which the line is to pass. Although the privilege of issuing capital stock to the amount of $20,000,000 is to be asked for, the initial incorporation will be started with a capital of $3,000,000. Where all of the money will come from with which to build and equip the line has not as yet been stated by the friends of the enterprise, but the supposition is that Boston capitalists will furnish the larger share, and that the remainder will be raised in New York and Philadelphia. The lines are to stretch from New York to San Francisco.

Mine Pumps Driven by Electricity.

At St. John's Colliery, Normanton, England, a set of pumps is now being worked by an electric motor of the Immisch type, which receives its current from a dynamo on the surface. The pumps deliver 39 gallons per minute to a head of 530 feet, that is, they exert a net power of 6.3 horses. The total efficiency of the entire system, including engine, dynamo, leads, motor, gearing and pumps is 44.4 per cent., the indicated horse-power being 14.2, and the net work performed, as stated above, being 6.3 horse-power. Of the indicated horse-power, 7.9 horse-power are, according to the annexed table:

PUMPS DELIVERING 39 GALLONS PER MINUTE THROUGH A HEAD OF 530 FEET = 6.3 HORSE-POWER IN THE WATER.

WORK DONE.	Speed of engine	E. H. P. given out by dynamo	Work done in cylinder of engine	Efficiency per cent.	Loss in cables, res. 39 ohms 800 yds. 12	
			H. P.			H. P.
Pumps delivering 39 gallons per minute	86	10.9 11	14.2	$\frac{6.3}{14.2} = 44.4$		.88
Pumps running with the suction clack lids off and the column empty	86	5 4.82 4.45	6.3			.305 .375 .265
Motor and first motion shaft only	88 86	2.96 2.8	4.8			.156
Dynamo only, running on open circuit	86	0	1.715			0

Expended in the following manner:

	Horse-power
Driving engine and dynamo empty	1.7
Overcoming resistance of leads	0.88
Driving motor and first motion shaft	2.8
Driving pumps empty	2.0
Other losses	0.52
	7.90

The pumps, gearing and engines were part of the colliery plant, and the motor was geared to the first motion shaft of the pumps by a cotton belt. It will be seen that only a small part of the loss in transmission can be ascribed to the electric plant. The friction of the engine, gearing and pumps would not be less with the pneumatic system of transmission, while with the hydraulic system the power required to lift the power water again to the surface would not be less than that now lost in the friction of the gear. The experiment has been so satisfactory that the colliery owners have given Messrs. Immisch & Co. an order for a dynamo and motor to deliver 120 gallons of water a minute to a height of 900 feet.

On a Geometrical Method of Determining the Conditions of Maximum Efficiency in Transmission of Power by Alternating Currents.*

BY MR. T. H. BLAKESLEY, M. A.

In this paper the author confines himself to the consideration of a simple circuit containing generating, conveying and recipient parts, in which the E. M. F. follows the law of sines. The maximum E. M. F.'s of both machines are supposed known together with the resistance and coefficient of self-induction of the complete circuit. The variable on which the efficiency of transmission depends is the difference of phase of generator and receiver. A geometrical construction is given by which the phase which gives maximum efficiency can be determined.

Mr. Kapp thought the construction would not apply where the receiver does mechanical work, owing to the E. M. F. not being a true sine function of the time. He also mentioned an experiment performed on a motor driven successively by alternating and direct currents, in which the *apparent* power $\left(\sqrt{e^{-2}}\ \sqrt{c^{-2}}\right)$ supplied by alternating currents was about five times that required when

* A communication read before the Physical Society of London.

direct currents were used, the motor giving out the same power in the two cases. From this he inferred that the ratio of power to weight is much greater for a direct than for an alternating current motor. This he considered a serious drawback to the use of alternate currents for transmitting power.

After some remarks by Professor Ayrton and Prof. S. P. Thompson, Mr. Blakesley said that by placing a condenser between the terminals of the recipient machine a greater current could be passed through the receiver than that in the generator and line.

The Barrett Electro-Medical Apparatus.

In a recent note we alluded to the fact that Mr. John A Barrett, well known in electrical circles, had for some time past devoted his attention to the designing of new types of electro-medical apparatus, as electrician of the Elektron Manufacturing Company, of this city; and we are now able to illustrate some of the apparatus referred to.

Mr. Barrett's ingenuity has for a long period been directed to the problem of providing a battery which should give the physician the least pos-ible trouble and still be in con-tant readiness for work. After numerous experiments he determined upon the use of the chloride of silver cell for this purpose. The well-known properties of this cell are that it remains practically constant in its action until the chloride of silver is completely reduced, and that no waste occurs when the battery is on open circuit. It required, however, a special investigation to adapt this type of cell to medical work, one of the principal points reached being the reduction of the internal resistance of the cell.

Another advantage of the battery is its portability, as a large number can be included in a very small space. This is well shown in the illustration, Fig. 1, which represents a complete fifty-cell battery and pole-changer, for general galvanization. The box and battery complete measure 10 × 6 × 7 inches, and weigh 11 pounds. The battery box which contains the cells can be lifted out of the case, and is shown in Fig. 2. The top of this box through which the studs and wires pass consists of hard rubber. The silver wires which are attached directly to the zinc and silver plates in the cells are passed up through the caps and plate and are fastened down under nuts which screw upon connecting studs; hence there are no connections underneath the plates, all being in sight and removed from moisture. When this inside case is in place, a polished hard rubber plate is laid over it, covering the nuts and washers, but with perforations exposing the connecting studs, as shown in Fig. 1.

The apparatus is so designed that the battery can be readily removed for the purpose of replacing it by a new set of batteries. This becomes necessary only at long intervals, however, as it is claimed that actual experience has shown that with the work demanded of them by an active practitioner the cells will last for at least two years. When finally they are no longer available, the batteries are sent to the makers and are replaced by a fresh set. The electrolyte being in the shape of a stiff paste, the batteries can be readily transported without danger of deterioration.

Our illustration, Fig. 3, show a 50-cell box, containing in addition a Faradic coil. The latter is complete in itself, comprising its individual battery, as shown in Fig. 4. The cell shown separate in Fig. 5 is also of the chloride of silver type, and the act of placing it in position underneath the coil puts it in the circuit of the latter, which is provided with the usual switch and vibrator.

Mr. Barrett has also designed a separate physicians' Faradic set, shown in Fig. 6. This contains two distinct secondaries, one of very fine wire giving high potential, and the other of heavy wire giving a current of greater strength. The regulation of the current is effected by the well-known Dubois-Reymond method of sliding the secondary over the fixed primary coil, and thus a large range of effects is obtainable with the two coils. The cells employed are contained in small wooden boxes which are held in place by spring clips that serve to make the contacts at the same time. For graduating the current when employing the large battery box, the water rheostat shown in Fig. 7 is employed, it being arranged to be attached to the pole-changer as shown in Fig. 8. The rheostat consists of an ebonite cylinder which is filled with water and within which a metallic plunger can be slid up or down so as to bring more or less water resistance into the circuit. In this way a rapid graduation of current can be effected without giving unpleasant shocks to the patient. We illustrate in Fig. 9 the universal handle for the various electrodes employed in electro-medical applications. The spring interrupter, as will be seen, stands normally closed, and the current is broken only when the button is pushed.

While originally designed for medical work only, Mr. Barrett's cell has proved so convenient that the Elektron Manufacturing Company has recently put the same into shape for miscellaneous work in the form shown in Fig. 10. These cells are in use on electric bell circuits, working models, telephones, and for miscellaneous work.

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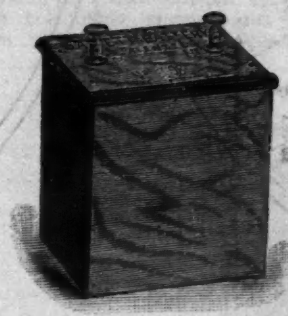

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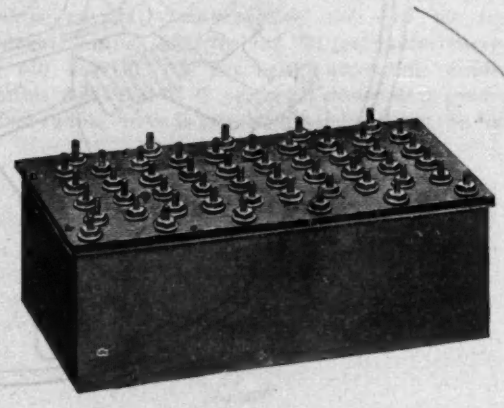

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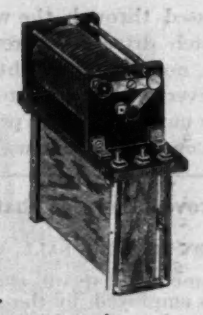

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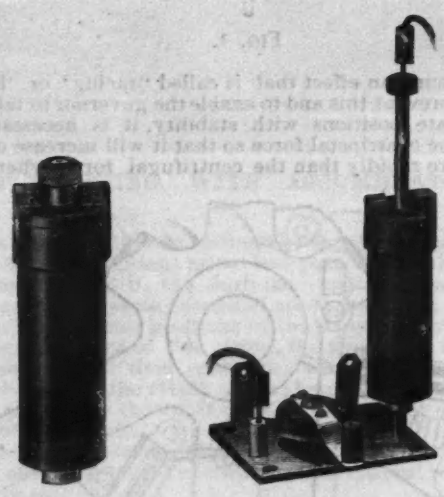

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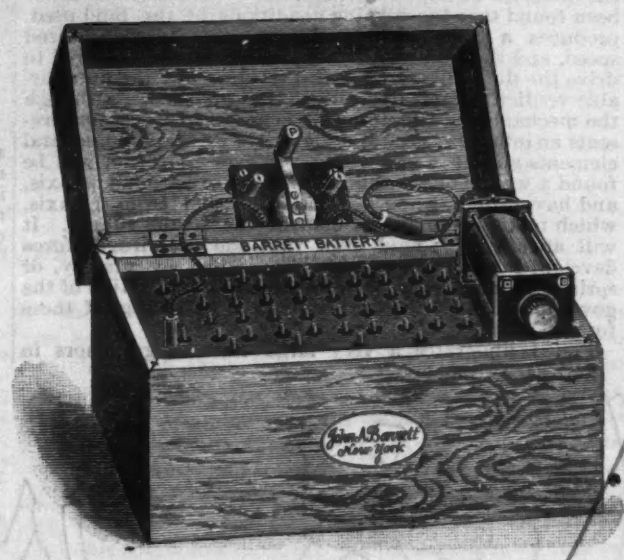

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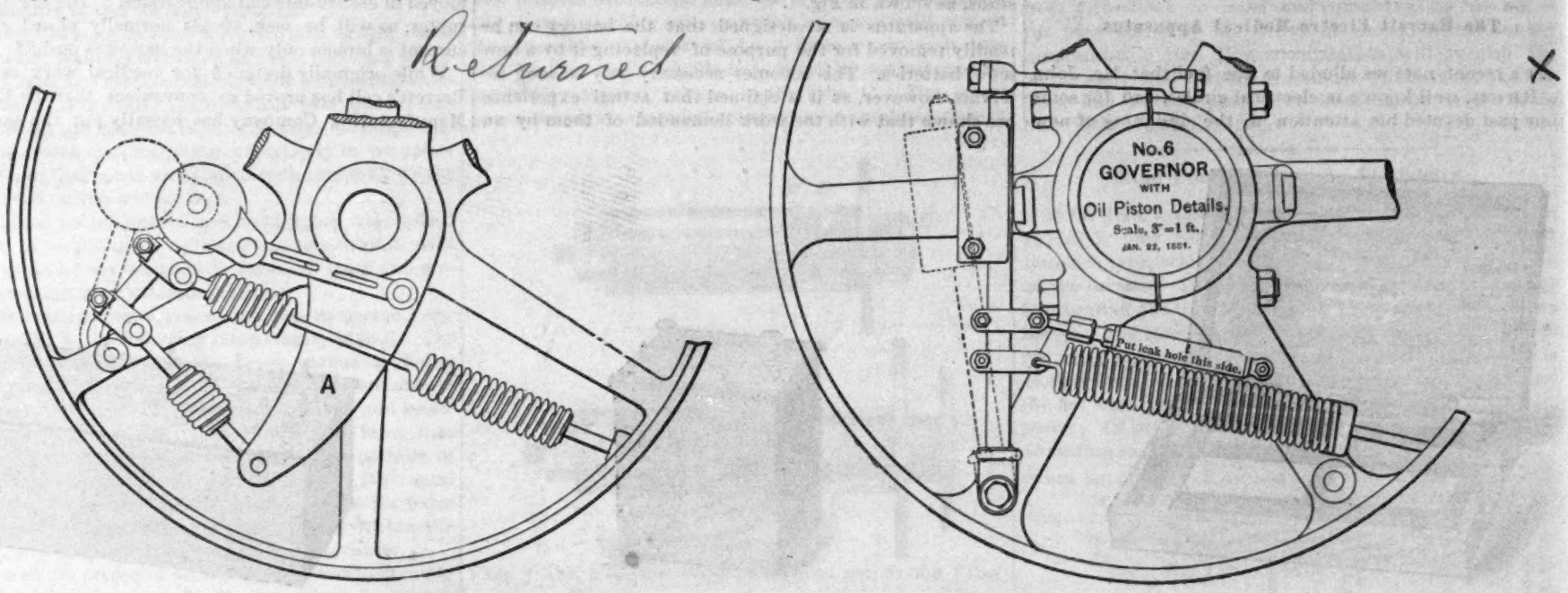
THE BARRETT ELECTRO-MEDICAL APPARATUS.

Electric Meters.

In the *Journal of the Franklin Institute* for December Prof. E. J. Houston describes various electric meters, the action of which is based upon the heating power of the current. After describing several forms of the Forbes meter, with which our readers are already acquainted, Prof. Houston draws attention to two instruments which are brought forward as anticipations of the Forbes meter. The first of these is described by the inventors, Messrs. Jehl and Rupp, of Brunn, in a letter to the London *Electrician*. This meter is claimed to have been constructed as early as June, 1883, and consisted of a heating coil placed within a tube filled with liquid, preferably olive oil. This tube was connected with a tank, and in the connecting passage was placed a small undershot wheel, attached to a registering apparatus. When no current was passing the liquid remained at rest. But upon the passage of a cur-

rent the resistance wire in the tube was heated, imparting heat to the liquid in the tube and creating a current in the liquid, which set the undershot wheel in motion, and thus registered the quantity of current passed through the meter.

The other meter described by Professor Houston is one which was patented in England in 1884 by Joseph Tavener. In this meter, a double-bulbed glass tube, similar in shape to the ordinary differential thermometer, has a wire spiral in each bulb, so connected that the current to be measured can be passed alternately through the wire in each bulb. The apparatus is poised at its centre of gravity. The current being passed through the wire in one bulb, expands the air, which drives a mercury column into the other bulb. This, now, being weighted, descends, making contacts which divert the current to the other bulb. An alternate see-saw motion is thus produced, that is measured by suitable counting apparatus.



FIGS. 2 and 3.—IMPROVEMENTS IN SHAFT GOVERNORS.

An Improved Form of Shaft Governor.*

BY FRANK H. BALL, M. E.

In the development of steam engine governors, from the earliest forms employed by the first designers, down to the latest production of modern engineers, it is noticeable that almost, without an exception, centrifugal force has been employed in every successful design. The only apparent success, without centrifugal force, has been in the direction of fluid governors, but even with these it has been found that the varying conditions of the fluid used, produces a corresponding departure from the desired speed, and the comparatively greater power required to drive the fluid governors is also a factor in the unfavorable verdict that practical use has established. Although the mechanical construction of centrifugal governors presents an infinite variety of designs, yet certain fundamental elements appear in every case. In every governor will be found a weight or weights made to revolve around an axis, and having a latitude of motion to and from the axis, which motion is made to control the steam supply. It will always be found also, that the centrifugal force developed by these weights, is opposed by gravity, or springs acting as a centripetal force. The action of the governor is therefore the result of a balancing of these forces.

Fig. 1 illustrates a very large class of governors in which the gravity of centrifugal weights is made to oppose their centrifugal force.

Springs are sometimes used in this construction to produce additional centripetal force.

Fig. 2 shows another type of governor, such as is commonly used on the main shaft of engines. In this form the gravity of one weight neutralizes the other, and springs are depended on entirely for centripetal force. In all these illustrations the weights are shown in their initial position, or the position nearest the axis, and the outer position is indicated by dotted lines.

In the operation of a centrifugal governor, any intermediate position taken by the weights must be one where the opposing forces are exactly in equilibrium. As the weights move outward from their axis the centrifugal force increases directly as the distance from the axis is increased.

The opposing or centripetal force may also be made to increase in exactly the same ratio or scale. If so arranged, then when the speed is such that the forces are in equilibrium in one position of the weights they will also be exactly balanced in every position from one extreme to the other, and an engine having a governor so adjusted might be expected to show the same rate of speed under every condition of load. Unfortunately, however, a difficulty arises in the nature of instability, for, if adjusted as described, then, whenever in any position of the weights the equilibrium between the opposing forces is disturbed by a change of speed, and the weights are thereby caused to move in the direction of the greater force, the same lack of equilibrium will exist when the weights have reached the extreme limit of motion in that direction, and when the weaker force shall have become the stronger, by reason of the rapid change of speed that must follow, then the weights will move immediately to their extreme limit in the opposite direction, repeating this process constantly

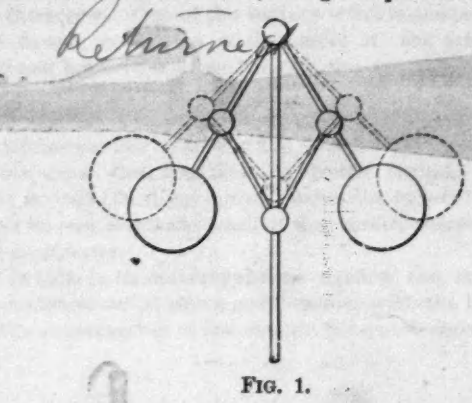


FIG. 1.

and producing an effect that is called "racing" or "hunting." To prevent this and to enable the governor to take all intermediate positions with stability, it is necessary to arrange the centripetal force so that it will increase or decrease more rapidly than the centrifugal force when the weights move from one position to another. If so arranged then a slight movement of the weights in the direction of the greater force will bring them to a position of equilibrium, and a still further change of speed will be required to move them to the next position. This condition of stability is, therefore, obtained at a sacrifice of uniformity of speed, and the greater the variation of speed between the extreme positions of the governor the greater stability will be obtained.

Every designer of centrifugal governors has had to face this problem and decide just how near an approach to perfect harmony between the opposing forces would be safe, knowing that if he approach too near he must pay the penalty of instability, which is a fatal error. The question as to how near this theoretically perfect condition it is safe to adjust a governor depends somewhat on certain conditions. Light balance wheels, extreme changes of load and friction in governing mechanism, are all elements which prevent a near approach to the condition of adjustment that should produce uniform speed. The inertia of the centrifugal weights is also an obstacle to fine adjustments, as it first prevents quick response and then overreaches the mark. For this reason high rotative speeds are desirable, as the necessary centrifugal force may be obtained from small weights having little inertia. A perfect governor should be free from unnecessary friction, and have as little weight to the moving parts as possible. Its function is essentially to weigh quickly and accurately two opposing forces, just as a steam engine indicator weighs the force of steam opposed to the spring, and yet there are those who load a governor down with weights other than centrifugal weights, merely to produce centripetal force, when a suitable spring would produce the desired force without the incumbrance of weight and consequent inertia.

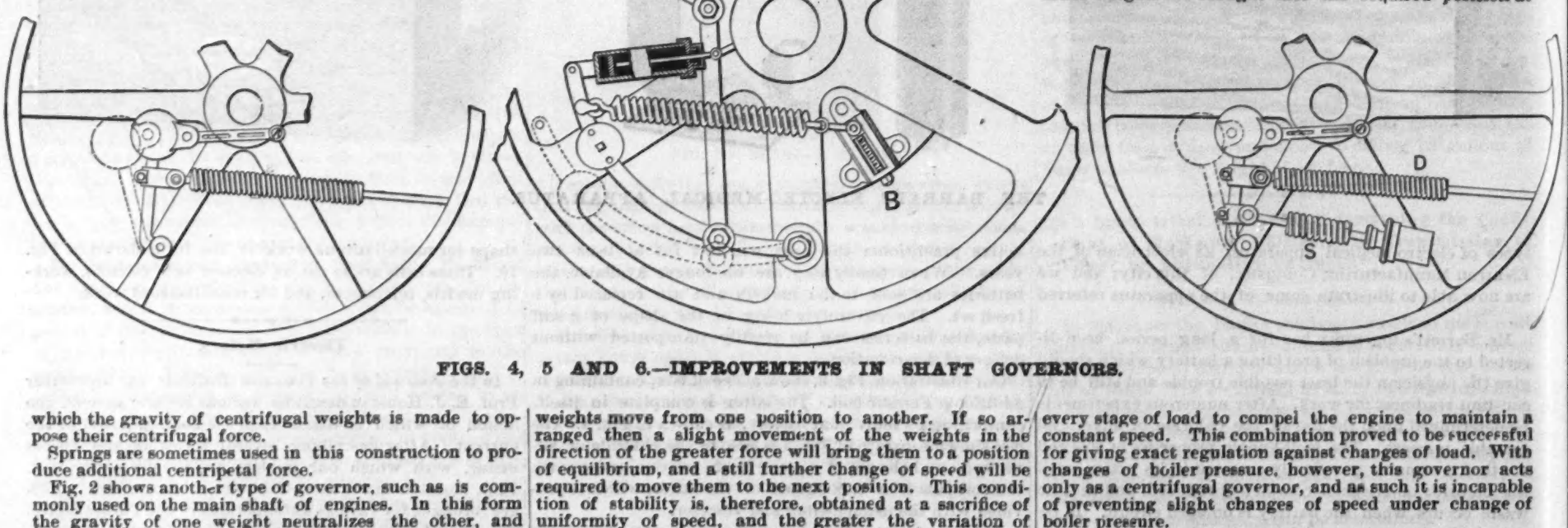
Recognizing the necessity of sacrificing theoretically correct regulation isochronism, as it is technically called, for the sake of stability with centrifugal governors, numerous attempts have been made to obtain a better result by other means. The fluid governors were found to come under the same general law as centrifugal governors, so far as the necessity of sacrificing isochronism for stability is concerned, and in addition to this other defects appeared which have already been mentioned. Several attempts have been made, in this country and Europe, running back through a period of over thirty years, to construct a governor without centrifugal weights, which should produce uniform speed by a weighing of the load. It is safe to say that not one of these was ever a success, for the obvious reason, if for no other, that they contained no provision whatever for governing against changing boiler pressure.

In 1878 the writer conceived the idea of constructing a centrifugal governor on the shaft of an engine having all the functions of the best forms of centrifugal governors for governing against changing boiler pressure, and also so arranged that the driving pulley, instead of being keyed to the shaft, is driven by the governor in such a manner that the load is made to act as centripetal force. With this arrangement the governor may be adjusted for ample stability, and the effort of the load adjusted to exactly correct the change of speed that otherwise would take place. Fig. 3 illustrates the arrangement for weighing the load. The curved arm *A* is keyed to the shaft and the belt wheel is driven from the connection at the end of this arm.

The effort of the engine is thus made to act as centripetal force, and by a suitable adjustment of this force, the governor weights are brought into the required position at every stage of load to compel the engine to maintain a constant speed. This combination proved to be successful for giving exact regulation against changes of load. With changes of boiler pressure, however, this governor acts only as a centrifugal governor, and as such it is incapable of preventing slight changes of speed under change of boiler pressure.

Where intermittent disturbances occur a great improvement is often derived from the use of a dash-pot or oil-cylinder having a piston with a small aperture for the fluid to pass from one side to the other, and attached to the moving part of the governor in a manner to prevent sudden motion. Rankine describes the use of a dash-pot in his book entitled *Machinery and Mill Work*, published in 1859, in Section 364.

Most of the builders of Corliss engines have found it desirable to make use of a dash-pot in their governors, owing to the inertia of the large slowly revolving weights, and



FIGS. 4, 5 AND 6.—IMPROVEMENTS IN SHAFT GOVERNORS.

*Read before the American Society of Mechanical Engineers, Philadelphia, Nov. 29, 1887.

also to the intermittent disturbances of the releasing valve-gear.

Among the shaft governors, or shifting eccentric governors according to the classification in the Patent Office, the Buckeye Engine Company, of Salem, O., seem to have been the first to apply dash-pots. They found that with large engines, where, owing to the slow rotative speed, the forces of the governors were weak in comparison with the intermittent disturbing elements to be overcome, that a dash-pot would materially improve the action of the governor. In 1878 they made use of dash pots in one of their governors on an engine at the Syracuse Iron Works, Syracuse, N. Y. A more uniform action of the eccentric was thereby obtained, and from this experience the same difficulty in other engines was remedied in a similar manner. In 1879 they put similar dash-pots on an engine at the works of White, Potter & Paige Manufacturing Company, of Brooklyn, N. Y., for the same purpose, and in 1880 applied the same remedy to a pair of engines at "Dow's Stores," Brooklyn, N. Y., following it up in 1881 on engines at the Hartford Carpet Company, and at the Pacific Mills, Lawrence, Mass., and many others which have not come under the writer's notice. Fig. 4, taken from a working drawing of a Buckeye governor with a dash-pot, shows the method of its application. It is here attached to the arm which carries the centrifugal weight, and through its connection with the eccentric is made to steady the action of the eccentric.

Profiting by the experience of the Buckeye Company and others, A. L. Ide, of Springfield, Ill., designed a shaft governor in 1882, having a dash-pot for preventing irregular motion of the eccentric.

Fig. 5 shows the construction of the Ide governor, and the manner of attaching the dash-pot, which is so identical with the Buckeye arrangement as to need no special description. The only novelty in this governor is the peculiar arrangement at *B*, where the end of the spring is attached to a sliding block, operated by a screw, the direction of motion being such that by this single operation a double effect is produced, that of shortening the arm or lever by which the weight is controlled, and at the same time increasing the initial tension of the spring.

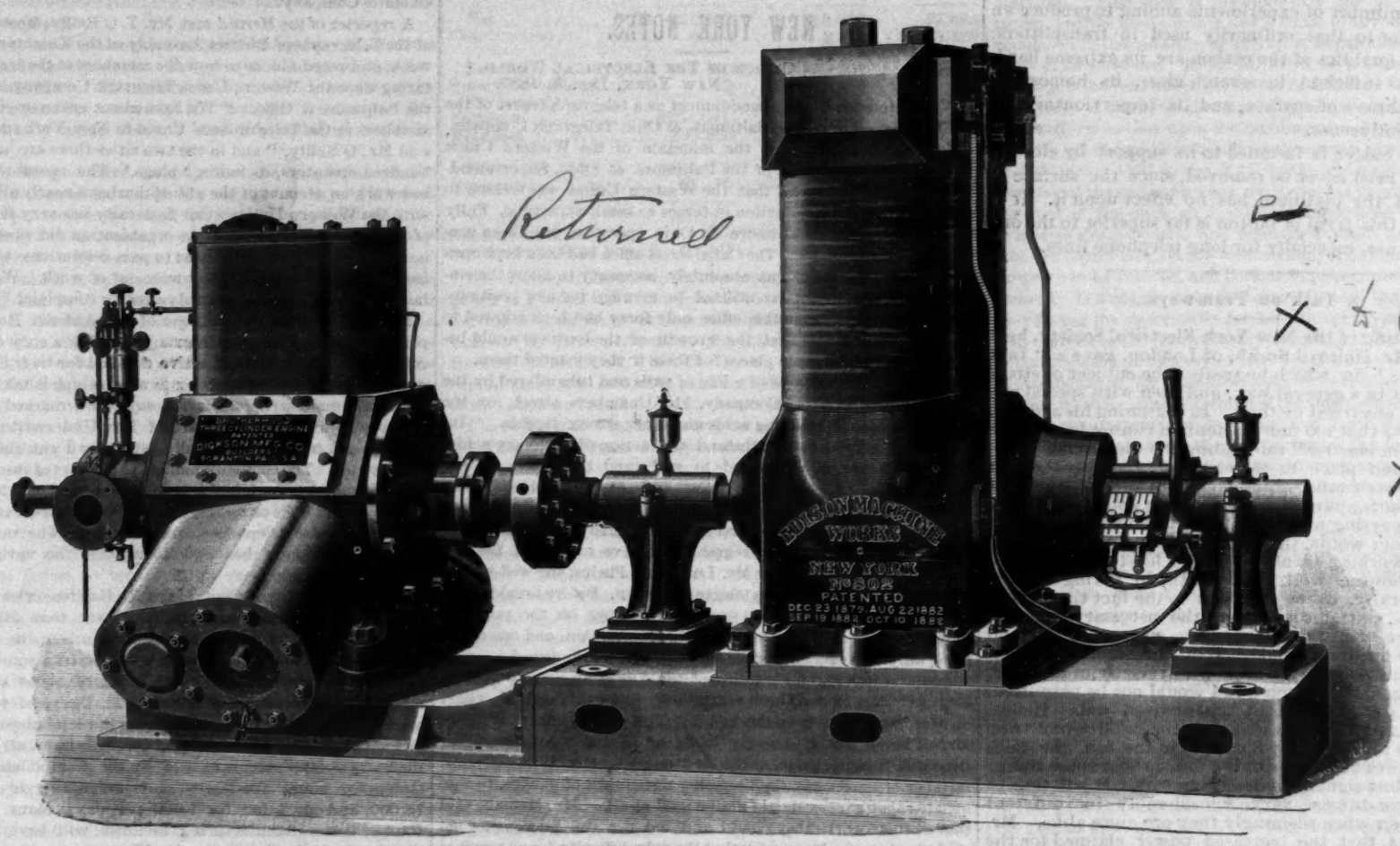
In centrifugal governors where the forces are weak and easily disturbed, this dash-pot permits a finer adjustment, and therefore makes the governor more nearly isochronous, but it also makes the action sluggish, and it is questionable whether without the dash-pot the governor cannot be made fully as nearly isochronous by increasing the forces of the governor. If so, the dash-pot is the less desirable remedy and amounts to a positive damage. A dash-pot governor of any of the kind described, adjusted to be strictly isochronous, must depend entirely on the resistance of the fluid for stability, and this resistance must become an important factor in the governor. Consequently the sluggish action must be exaggerated or increased, thereby producing disastrous results. When a governor is thus arranged and adjusted, if in the operation of the engine it becomes necessary for the governor to move from one position to another, it cannot do so quickly, but must drag along tardily, during which time the engine is getting badly off its speed. Therefore the former instability in the nature of rapid and extreme fluctuations of speed is changed by the dash-pot to more moderate fluctuations, each of which covers a longer interval of time. Dash-pot governors, such as have been described, do not appear to be capable of giving satisfactory results under a finer adjustment than is employed with strong centrifugal governors without dash-pots. At least such would be a fair inference from the fact that the great mass of governors are still made without dash-pots after more than a quarter of a century of experience with their use.

During the past year the writer has discovered a new application of a dash-pot to centrifugal governors, which seems to be entirely free from the difficulty formerly encountered. The principles involved may be understood by reference to Fig. 6. The governor here shown is one of the ordinary forms of shifting eccentric governors. The introduction of the spring *S* between the dash-pot and the movable part of the governor is the new feature. Its operation and effect is as follows: Suppose the long spring *D* be drawn up until its initial tension, in distance of stretch, shall correspond exactly with the distance between the centre of gravity of the weight and the axis of revolution. This is what is called "full theoretic tension." The condition is the same as would be obtained if the weights were first placed at the centre of the shaft, and after attaching the spring without any tension the weight was then moved out to the position shown.

With this relation between the position of the weight and the tension of the spring, the increase and decrease of centrifugal force caused by moving the weight to or from the axis of revolution, would exactly harmonize with the changes of resistance of the spring due to said motion, and if the two forces were in equilibrium in one position, they would be so in every position at the same speed. This condition, as has already been said, should be expected to give uniform speed of the engine at every position of the governor, but has been found impracticable on account of its instability. The object of the dash-pot and spring here shown is to allow the theoretically perfect adjustment of the long spring, and to furnish ample stability without making the governor sluggish, or in the least preventing a quick and delicate balancing of the forces. This spring *S* is arranged for both compression and extension, and has a range of deflection sufficient to allow the full motion of the governor, from one extreme to the other, without regard to the motion of the piston of the dash-pot to which it is attached. The resistance of this spring "*S*," having no initial tension, is entirely out of harmony with the other springs, and combined with them produces exactly the effect when motion takes place that is obtained ordinarily in centrifugal governors by using springs with less than the full theoretic tension, and if the dash-pot piston should remain stationary, the same change of speed would be found between the extreme positions of the governor, but by reason of the movement of this piston, the tension on spring *S* is released, and it then ceases to be a factor in the speed, which is only the result of the long spring, and, as has been previously shown, it must be the same at every position of the weight.

This theory, though somewhat obscure, seems to be correct, and its practical operation under careful tests proves it to be so.

Governors are now made of various types, embodying this principle, and have been found to compel the same number of revolutions per minute of the engine under any condition of load or boiler-pressure within the full capacity of the engine.



PLANT FOR ISOLATED LIGHTING, WITH ACCUMULATORS, IN NEW YORK CITY.

Isolated Electric Lighting with Accumulators in New York.

The convenience of being able to draw upon a source of electricity at any time independent of the operation of an engine is being recognized more and more, and storage batteries which afford this advantage are becoming more generally applied every day. Several notable installations are already placed in this city, the largest of which is in the new telephone building in Cortland street. There 600 cells furnish a constant supply for the incandescent lights to draw upon.

The installation recently put into the new Gallatin Bank on Wall street also deserves attention. It consists of 159 cells of the Electrical Accumulator Company's make in three series of 53 each placed in parallel. These are charged from a specially wound Edison dynamo, mounted on the same base plate with a Brotherhood 3-cylinder engine and running at about 380 revolutions per minute. Our illustration shows the combined engine and dynamo. The plant gives the utmost satisfaction and occupies but a very small space.

Among other storage battery installations recently put in in this city we may mention those for the American Express Company, the American Bank Note Company and the Dakota flats, in West Seventy-second street.

Long Runs of Storage Cars.

To the Editor of The Electrical World:

SIR: A short time since I took the liberty of asking you whether the run recently made by the new eight-wheel car in Philadelphia, fitted with Reckenzaun motors, viz., forty-five miles, with one charging of the batteries, had been equaled, and you stated it had not been, so far as you knew. However, Mr. C. O. Mailloux, in your issue of Nov. 26, states the Julien car in New York has equaled it by running *forty* miles. This reasoning is bold and original, even if not conclusive; but how about the *shortage of five miles?* The track around our yard is 1,005 feet long for each round or lap, with four curves, and one ascending and one descending grade on each lap. In the run of forty-five miles, 2 miles 4,671 feet consisted of 33 feet radius curves; 7 miles 2,266 feet, of 50 feet radius curves; 3 miles 2,701 feet, of 100 feet radius curve; 4 miles 210 feet of $5\frac{5}{16}$ per cent. ascending grades, and 5 miles 3,544 feet of 6 per cent. descending grades. The 33 feet radius curve is located immediately at the foot of the ascending $5\frac{5}{16}$ per cent. grade, so that no impetus can be gained for the ascent; and on each lap are two switches with their frogs, also one right angle steam railroad crossing. In fact, the whole track is purposely arranged to be a hard one for testing purposes. It has been twice carefully measured in all its details by competent engineers, and there are no long straight stretches of track which exist on tracks through the streets, and are so favorable to the operation of electric cars. Further on in his communication, Mr. Mailloux says again that he does not consider his "*forty-mile*" run a wonderful thing, and that he feels he can do better hereafter. In this hope we should all unite with him.

WM. WHARTON, JR.

PHILADELPHIA, Pa., Nov. 29.

The Resistance of Armatures.

To the Editor of The Electrical World:

SIR: An armature for a dynamo has a resistance between diametrically opposite segments of .03 ohm when measured with "Wheatstone" bridge. A claims that the running resistance is the same; B claims that the resistance when running is only one-half of the same. Will you kindly decide who is right and oblige an

AMATEUR.

ANSWER.—Neither A nor B is right. The actual running resistance of an armature is usually greater than that measured when the machine is not running, and the amount of increase depends upon the construction of the machine. A spurious resistance is usually added to the true resistance; it is due to the effect of self-induction and increases with the speed of the machine. The greater the number of turns of wire on the armature the greater is the extent of the increased resistance. Hence in arc light machines this spurious armature resistance is far

greater than in incandescent dynamos, where frequently a single turn of wire constitutes a section of the armature winding.—EDS. E. W.

A Simple Domestic Motor.

To the Editor of The Electrical World:

SIR: In THE ELECTRICAL WORLD for Oct. 3, 1885, on page 143, is a cut of a simple domestic motor and the directions for its construction, in regard to which I would like to ask a few questions. It states that the spool is made of wood, 5 inches long, 2 inches diameter of flanges, 1 inch outside diameter of core and ¼-inch hole. Upon this spool is to be wound four pounds of No. 10 B. & S. gauge cotton covered wire. I am unable to understand how four pounds of No. 10 wire can be put on this spool of five inches length and of but one-half inch from outside of core to end of flange. Will you please give me this information and oblige, Yours truly, W. S. L.

ST. PAUL, Minn.

ANSWER.—The weight there given is probably only approximate. The idea is to fill up the spool with No. 10 wire.—EDS. E. W.

A New Carbon Telephone Button.

We have had our attention called to a new microphone button recently brought out by Messrs. Woodhouse & Rawson, Limited, of London. It is said to be the result of a considerable number of experiments aiming to produce an article superior to that ordinarily used in transmitters. The essential qualities of the carbon are its extreme hardness, which is sufficient to scratch glass, its homogeneity, its smoothness of surface, and its imperviousness to atmospheric influences.

The carbon button is fastened to its support by electroplating, as it need never be removed, since the surface is so hard that the platinum has no effect upon it. It is claimed that this form of button is far superior to the one ordinarily in use, especially for long telephone lines.

A Talk on Tramways.

At the meeting of the New York Electrical Society, held on Nov 30, Mr. Holroyd Smith, of London, gave a "Talk on Tramways," in which he treated the subject of street railroads, first in a general way, and then with special reference to the electrical method. In beginning his address, Mr. Smith said that too much attention cannot be given to the fact that in electrical railroading the electrician occupies the second place to the engineer, and that the past failures in electric railroading have been due to the fact that electricians, pure and simple, have gone into the domain of engineering without sufficient knowledge to guide them. In other words, the electrician must not expect to succeed in working tramways unless he studies the engineering problems as well. Mr. Smith, in taking up the subject generally, drew attention to the fact that American railroads, or tramroads, were the necessary outcome of the generally bad ordinary roads, whereas in England the roads are uniformly good. While in America the centre bearing rail is employed almost universally, in England, and abroad generally, such a rail would not be permitted, and recourse must be had to the grooved rail. Hence, while with American cars and rails the coefficient of traction amounts to about only 8 pounds to the ton, the English rail requires 23 pounds to the ton, so that these things must not be lost sight of in designing cars. It will thus be seen that conditions vary considerably in different countries, even when seemingly they are quite alike. Mr. Smith asserts that the increased power claimed for the driving motors is due to the overestimation of the power required to move the car.

Mr. Smith then entered into the consideration of traction by horses, compressed air, steam and cable, and deplored the fact that while in England the statistics of running expenses of horse-car lines were well-known and published in Duncan's *Tramway Manual*, we had no such source of information, and it was with the greatest difficulty that any reliable figures could be obtained with regard to the subject on American lines. Mr. Smith stated that as a rule in England a 2-horse car running for 14 hours a day required 10 horses. These horses cost £30, and had an average life of 3 years. In discussing the question from the electrical standpoint, Mr. Smith drew attention to three essential points that have to be considered: 1. Safety to the public. 2. Efficiency. 3. Economy.

Taking up the storage battery first, Mr. Smith held the position that even if the battery could be successfully worked, it would cost one-third more to equip and run a line on this system than to put down a conduit, and especially would this be the case where traffic is very heavy. Mr. Smith was of the opinion that of the various systems the overhead system was the best, taking all into consideration; but the great danger in its use lay in the tendency to do slipshod work. The difficulties met with at crossings and switches in railway work where conductors of opposite polarity met in a horizontal plane are overcome by placing the conductors in a vertical plane so that even if contact does occur it can only happen between two positive or two negative conductors. Mr. Smith finally described a new method of his own which was designed to overcome all the objections to both the overhead and underground circuits, and which, without the use of the storage battery, is arranged to supply the motor on the car with electricity. This system, which was only hinted at by the speaker, will no doubt attract some attention in the future.

In the discussion which followed, Mr. T. W. Rae spoke of the experiments made on cars in this city by Mr. C. E. Emery, the well-known engineer, who found that the coefficient of traction was 12½ lbs. per ton; and General Q. A. Gilmore states that the general average for the whole country is 16⅔ lbs. per ton.

Mr. R. G. Blackwell, whose opinions on this subject are well known, deprecated the use of the storage battery entirely, and, in replying to a question, remarked that the delay in the construction of the Fulton street road in this city, undertaken by the Bentley-Knight Company, was due to legal complications; and that all the material required for the road was in store in this vicinity, ready to be applied at the earliest notice.

Mr. C. O. Mailloux in replying to Mr. Blackwell, detailed the experiments which are now going on upon the Madison avenue line in this city, on a car equipped with 120 cells of Julien storage battery, and which ran from 85th street to Harlem Bridge and back, on a run of 40 miles, with a drop of but 2 volts. Mr. Mailloux stated that the Brussels Tramway Company are now operating 10 cars of this system and that before many months have elapsed New York will see as many storage cars in operation. Mr. Mailloux drew special attention to the fact that storage batteries were well adapted to long lines on account of the large conductors required with the overhead and underground systems, where the drop of potential has to be made as small as possible.

Mr. Holroyd Smith confirmed this statement of Mr. Mailloux, but he still claimed that the use of the storage battery was only a transient one. In reply to a question by Mr. Davidson as to whether a conduit had ever been operated in this country, Mr. R. G. Blackwell referred to the experimental line operated in Cleveland on the Bentley-Knight system, and carried on through snow, ice and water without trouble. Mr. Smith also confirmed this fact, and stated that the last winter had been most severe in Blackpool, England, where his road was in operation, but notwithstanding this, the current had practically not stopped in three years since the road went into operation.

After the close of this discussion Mr. G. F. Harris brought before the Society a slip of the cable record made by one of the first Thomson siphon recorders, on the cable between Vigo and Penzance, and also made a few explanatory remarks relative to cable work.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Dec. 5, 1887.

With reference to the abandonment as a telegraph centre of the Canal street office of the Baltimore & Ohio Telegraph Company, which was announced as the intention of the Western Union when it assumed control of the Baltimore & Ohio, Superintendent Humstone has stated that the Western Union was seeking to make the necessary reduction in forces as small as possible. Fully 70 per cent. of the Baltimore & Ohio operators had been provided with new places. The Canal street office had been kept open six weeks longer than was absolutely necessary to allow the employés who could not be utilized to arrange for new positions. Out of 115 operators in this office only forty had been allowed to go. It was probable that the growth of the business would before a long time provide places for these if they wanted them.

"Fiberite" is the name of a line of pails and tubs offered by the Union Indurated Fibre Company, 110 Chambers street, for the special purpose of handling acids and other strong liquids. "Indurated fibre" pails will withstand the action of ordinary acids, but the fiberite is warranted to withstand the action of the most corrosive chemicals. Brass and copper workers, wire manufacturers, paper mills, tanneries, and all who handle strong solutions will find this line particularly adapted to their use.

It is with much pain and regret that I have to record the bereavement just suffered by Mr. Lucius J. Phelps, the well-known inventor of the Phelps train telegraph system. Before breakfast on Friday morning last his two sons went skating on the ponds at Passaic, where Mr. Phelps lives. The ice was thin, and one of the boys, only 10 years old, broke through and was drowned.

At the recent regular meeting of the American Society of Civil Engineers Mr. S. S. Wheeler exhibited and explained his chart of wire gauges lately published by THE ELECTRICAL WORLD. Mr. Wheeler spoke strongly in favor of the "American," or Brown & Sharpe gauge, as the best in use. Mr. Wm. Metcalf, member of the society, in discussing the subject of gauges, recommended that gauges should not be used at all. Mr. Metcalf said that at their works they could and did use the micrometer entirely in place of wire gauges; that the only difficulty found was that when first using the micrometer a person would get the idea into his head that the mark on the circle which stands for thousandths of an inch really was thousandths of an inch. Mr. Wheeler thought that the use of the micrometer was not practical among rough workmen and people who had no experience in its use, to which Mr. Metcalf replied that they, as a firm, had had no difficulty whatever.

The Empire City Electric Company, 15 Dey street and 779 Broadway, has just issued a new and elaborate catalogue of no fewer than 90 pages. It embraces a large variety of electrical supplies, as well as a considerable number of specialties made by the company. In method of arrangement and style of publication it is a model, and reflects great credit on the compiler. The company is doing a heavy general business. It reports a big demand for its bells and annunciators, as well as for glass and porcelain insulators, pins, cross-arms, etc., and for electric light supplies, including underwriters' wire, for indoor and outdoor use, of which it is making big shipments. The company has been appointed sole agent for the Guion heat regulating apparatus, now bidding so effectively for public favor. It may be mentioned that in order to keep pace with its business the company is increasing its capital stock.

The Okonite Company, of 13 Park Row, has just issued a new price list of its wires and cables for 1888. It is a pretty little pamphlet containing not only a lot of information about okonite, with a number of first-class testimonials from leading electricians and experts, but formulæ for ascertaining weight, sizes, etc., coefficients of temperature from 50 to 70 degrees Fah., and tables of gauges, weights, areas, etc. Mr. W. L. Candee, the popular treasurer of the company, has returned lately from a trip West, and reports most gratifying success in placing large quantities of the okonite specialties. Up to Dec. 1, the call for incandescent lighting conductors, Nos. 14 and 16 wire, for interior use averages over 400,000 feet per month. Of tape, over 300 pounds went recently to Chicago on one order. Last month 36 miles of okonite wire were shipped to England. Candee wire has of late been in such demand that the company has practically had to stop taking new orders for it. Altogether the business of the present year is over double that of last year. In order to meet New England wants, Pettengill & Armstrong, at 95 Milk street, Boston, have been appointed agents for the company in that section.

Chas. A. Schieren reports sales of leather link belting as follows within the last week: Wilmington City, Del., Electric Company; Bath, Me., Electric Light and Power Company; La Crosse, Wis., Edison Light and Power Company; Newton Electric Light and Power Company, Newtonville, Mass.; Thomson-Houston Electric Company, Lynn, Mass.; Edison Electric Illuminating Company, Williamsport, Pa.; American Illuminating Company, Hornellsville, N. Y.

The Consolidated Telegraph and Electric Subway Company have made application, under the recent order of Commissioner Newton, for permits to complete certain connections in the subway. General Newton has acted on two of their applications, and has issued permits for the completion of about four hundred feet of subway on Fifty-third street, between Sixth and Seventh avenues, and for about one hundred feet at Fifth avenue and Twenty-seventh street. He has not yet acted on the remaining applications. Engineer Beckwith has received from Deputy Commissioner D. Lowber Smith a communication in which the openings at Spring street and the connections under contract with the Averill Insulating Conduit Company are excepted from the general order to suspend work on Dec. 1 and to recall permits. The permits must, however, be reindorsed and the work conducted according to the terms laid down in the circular sent to all the excavating companies. This circular states that "during the winter months in the absence of heavy frosts the streets may be opened for laying pipes and other purposes. The openings must be so regulated that they can be closed within twenty-four hours."

Mr. E. P. Wetmore was in town last week. This bright young engineer has been busy on the new Sprague road at Richmond and now goes on to Harrisburg, Pa., where another Sprague road is to be built. He is a brother of Mr. Jean Wetmore, of the Okonite Company.

A reporter of the *Herald* met Mr. T. O'Reilly, Master Workman of the Telegraphers' District Assembly of the Knights of Labor, last week, and asked him as to how the members of the fraternity were faring since the Western Union Telegraph Company had absorbed the Baltimore & Ohio. "We have about seven or eight hundred members in the Telegraphers' Union in New York and Brooklyn," said Mr. O'Reilly, "and in the two cities there are about eleven hundred operators, including 'plugs.' The operators who have lost work on account of the absorption have nearly all found work with the Western Union. Our fraternity has very few people out of work, and the first thing the organization did when the Baltimore & Ohio was absorbed was to pass resolutions to sustain the lady operators as long as they were out of work. We are doing fairly well and have no general cause for complaint."

Mr. T. L. Fowler, the manager of the Ansonia Brass and Copper Company, put in my hands last week a copy of their new catalogue. He reports an active demand for their fireproof and weatherproof line wire and house wire, which is taking the place of the old underwriters' wire, he says, in a marked manner. It has been approved by the Board of Fire Underwriters. Any one of the WORLD readers who will send his card can obtain a sample of this wire. The company make also all lines of insulated copper wire for magnets for telephone, telegraph and electric light service, wrought bells or gongs, drawn copper bars, battery copper, brass strips for telephones, zinc rod, etc. The new catalogue shows in addition to these and other goods the various tables of wire gauges in use.

I understand from Capt. Hugh R. Garden, vice-president of the Sawyer-Man Company, that no fewer than 300,000 incandescent lamps have now been installed under the Sawyer-Man patents, which under the new state of affairs assume such importance. Pittsburgh alone shows a total of about 21,000 lights, while Minneapolis counts in for 6,500, Denver for 6,550, Baltimore, 5,000, and so forth, making up the total above named, and included in over 400 isolated and central plants, all protected by the Sawyer-Man patents as held by the Consolidated Company. Orders for lamps are heavy, some amounting to 100,000 and 75,000, and one being for 1,000 per day. Many of these, for want of better manufacturing facilities, will have to await the completion of the new factory in West 23d street, this city, when the Consolidated Company will have an output of 10,000 lamps per day.

It is appropriate here to mention the sad bereavement sustained by Mr. H. C. Davis, the estimable president of the Sawyer-Man Company, in the sudden death of his father in Boston. Mr. Davis, Sr., a resident of Philadelphia, was a son-in-law of that celebrated woman, Lucretia Mott, the abolitionist, and was on a visit to Boston with his wife to their children, all of whom were there at Thanksgiving time except Mr. H. C. Davis. The old gentleman was suddenly attacked with heart disease in a horse car, but retained his presence of mind and gave his address. The interment took place at Philadelphia, where the family is well known.

The police have been raiding some of the bucket shops, and promise a vigorous campaign in this field. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Dec. 5, 1887.

Mr. Arthur B. Griggs, of New York, special agent of the American Electric Manufacturing Company, is temporarily located in this city; his office is at the company's Boston headquarters, No. 197 Congress street.

Mr. Wallace S. Clark, connected with the Edison United Manufacturing Company's construction department, passed through this city on Saturday *en route* for Brockton, Mass., where he will take charges of the changes being made in the local electric light station of the Edison Electric & Illuminating Company.

The Edison Electric and Illuminating Company, of Brockton, Mass., has added to the lighting equipment of its station a 50 arc light dynamo of the American Electric Manufacturing Company. During the past month the local company has furnished 15 arc lights, and since the starting up of its municipal system (Oct. 1), about 125 incandescent lights have been added to the original city contract of 350. Brockton's streets are lighted exclusively by electricity.

Messrs. Paine & Francis, the New England agents of the Edison United Manufacturing Company, report the installation of solated Edison plants on which their men are at work as follows:

450 lights at the station of the Claremont, N. H., Electric Light Company, and 75 lights at the paper mill of Messrs. F. W. Bird & Son, East Walpole, Mass. The New England Wiring and Construction Company has the wiring work of these plants in hand.

The Sawyer-Man Electric Company, of New York, through its New England agent, Mr. P. H. Alexander, has finished the installation of an isolated electric light plant of 180 incandescent lamps at the Park Central Hotel, Hartford, Conn.

The Thomson-Houston Electric Company has just completed the installation of a 400-light direct incandescent plant in one of the large factory buildings of the American Screw Company at Providence, R. I. Mr. M. W. Turner, of the Thomson-Houston Company, has had charge of putting in this isolated plant; and he deserves the highest praise for the excellent judgment displayed and painstaking work manifested by him in his supervision of the installation referred to. The American Screw Company's factories will require altogether at least 3,000 incandescent lights, of 16 c. p. each, to give satisfactory illumination, and it is quite probable that within the next sixty days an additional order of 2,000 or 2,500 lights will be given the same electric light company.

Mr. John T. Moriarty, Boston, the New England agent of the New York Accumulator Company, reports having closed a contract for a nicely located building in the business centre of Newport, R. I., in which will be placed several Edison dynamos and all the requisite equipment for a small central station. Banks, public buildings, stores and residences are to be supplied with accumulators and the new Edison 60-volt lamps. The former, being compact in form and taking up very little space, will be placed in the basements or cellars of the buildings. A wire will be run to each set of accumulators from the central station, furnishing all the current required.

Mr. Moriarty reports also a novel and interesting installation now being made by him at the Commonwealth boot and shoe factory, Whitman, Mass. To explain: a few sets of accumulators will furnish current for a number of "Simplex" arc lamps. Experiments already made indicate that this installation will be successful.

Scarcely six months have passed since the completion of the electric light station at Dover, N. H., and yet to-day it is one of the most prosperous enterprises of the kind in New England. On Friday evening, Dec. 2, a notable event transpired at the station referred to, which will be long remembered by the citizens of Dover, and went far to substantiate the fact that the good people of that lovely and thrifty little city are proud of the magnificent electric light installation in their midst. Mr. H. W. Burgett, the promoter of this electric light enterprise and at present the treasurer of the company, sent out the following invitation to the city officials and business men of Dover, under date of Nov. 30, 1887: "The works of the Dover Electric Company are now substantially complete. It goes without saying that electric lighting has been brought to a point of excellence equally unexpected and creditable, and that the power and skill employed fully meets the present want, realizing even the mystic force and fabled art of the magician. But it is believed that a more general knowledge of the machinery, enginery and mysterious organization involved in producing our product would be of value to all concerned. So that, with the intent to secure fuller recognition, the management desires to meet the business men of Dover in a social way. To this end you are invited to be present at the works of the company Friday, Dec. 2d, at 7:30 P. M. Lunch will be served at 9 o'clock.

In response to the invitation about 175 gentlemen met at the station and after being escorted through the engine and dynamo-room and over the steam plant by Mr. Burgett and his assistants, all were cordially invited to the upper hall, where tables were laden with a collation. Mr. Harvey Blunt, of Boston, was the caterer. Immediately following the luncheon Mr. Burgett addressed his guests with a few well chosen remarks in which he feelingly referred "to the friendship, good will and hearty co-operation he had met with from the city officials and business men of Dover." In conclusion he said that "he would call upon several of the gentlemen present to express their individual views regarding electricity as an illuminant, and if, in their opinion, he had fulfilled the promises made by him before the city government granted him the franchise for lighting the streets of Dover. Among the prominent gentlemen who cheerfully responded to the invitation to speak were members of the New Hampshire Legislature, Aldermen of Dover, and several of the most prominent business men of the city. The expressions used by all those who spoke were highly complimentary to the electric lights and of a most friendly character to Mr. Burgett. It was the unanimous verdict that the host had not only fulfilled his contract with the city government, but had undoubtedly given Dover an electric light station which stood second to none in the country as regards equipment and its appointments. It will suffice to say that the opening of the Dover electric light station was a most successful event, and one highly complimentary to Mr. Burgett, who has been identified with the Thomson-Houson Electric Company for a long time. Under his supervision several of the most successful electric light enterprises have been installed and are in a prosperous condition to-day.

A brief description of the Dover station will be in order. It is a frame building of regular mill construction. The main building is two stories high, 38 × 46; the boiler-house adjoins it with dimensions 28 × 40, and is built of brick (with rock foundations) 1½ stories in height. The entire lower floor of the main building is used as the engine and dynamo room. The equipment of this department is as follows: Three 60 h. p. Armington & Sims engines, four 50 arc-light Thomson-Houston dynamos and two 400 incandescent light Thomson-Houston dynamos. To this equipment will soon be added all the necessary apparatus for the alternating system of incandescent lighting. The boiler room is supplied with the following equipment: One 200 h. p. boiler, with Jarvis furnace set with Sheffield grate bar for burning screenings; a National feed-water heater, a Korting injector and Knowles pump. The Jarvis Engineering Company, of Boston and New York, equipped the steam plant, and that company deserves every word of the praise expressed by those who inspected the boiler room on the night of the opening. The foundations for the engines, dynamos and boilers are as solid as engineering skill and the handiwork of experts could make them. They are first laid upon ledge rock, then come solid pieces of stone interspersed with cement, and on the top masonry of brick and cement. These foundations run the entire length of the station, that is, underneath both the engine and dynamo room and the boiler room.

The arc lights, about 150 in number, are nearly equally divided between street and commercial lighting. Along the principal streets they are placed either on poles of ordinary height or suspended from mast arms midway across the thoroughfare. In the suburbs, higher poles are used, owing to the residences being some distance apart. About 60 series incandescent lamps (65 c. p.) and between four and five hundred direct incandescent lamps (16 c. p.) are in use, while orders are in hand for several hundred more incandescents, including both the series and direct lamps. The various circuits required upward of twenty miles of wire. Both the "Clark" and the Campbell wire is used.

The City Hall building is thoroughly lighted with the incandescent system, there being 169 lamps (about one-third series lamps of 65 c. p.) used. The Opera House which occupies the entire upper part of the City Hall building takes over one-half of the 169 lamps referred to and these are so arranged that the effect is very fine.

At the close of the Boston Stock Exchange on Saturday, Dec. 3, telephone stocks were quoted as follows:

American Bell Telephone	$218
New England Telephone	40
Erie Telephone	31⅛

The Boston dailies of Sunday, Dec. 4, contain the following regarding the Erie Telephone Company:

Erie Telephone gained ¼ to 31⅛. The statement of the company for October and seven months tells a favorable story, as under:

October.	1887.	1886.	Increase.
Earnings	$53,831	$46,015	$7,816
Expenses	32,283	32,132	151
Net	$21,547	$13,883	$7,664
Construction	6,464	2,975	3,489
Surplus	$15,083	$10,907	$4,176
Subscribers added	62	53	9
Seven months:			
Earnings	$354,041	$310,400	$43,641
Expenses	230,966	207,168	23,798
Net	$123,075	$103,232	$19,843
Construction	27,470	17,232	10,238
Surplus	$95,604	$86,000	$9,605
Subscribers added	639	407	232
Subscribers added Nov. 1.	10,361	9,331	1,030

The American Telephone Improvement Company has been organized in Portland. The purposes of the corporation are purchasing and holding the inventions of Stephen C. Drew. President, Charles H. Drew; treasurer, Horatio N. Holbrook; directors, Horatio N. Holbrook, Chas. H. Drew, Stephen C. Drew. The capital stock is $1,000,000; paid in $1,000,000 by the assignment of invention and application for letters patent and $200 in cash.

I have the following interesting notes from Mr. J. S. Meech of the Thomson-Houston International Electric Company, who is now in Boston:

We have lately made an arrangement for the transfer of our entire rights for Italy to the Messrs. Bellani Fratelli, of Turin. This transfer has been made on very advantageous terms, and the Messrs. Bellani are prepared to push the system in that country with the utmost vigor. They have tried several other systems, and not finding them satisfactory, were induced nearly 6 months ago to put in one of our 30-light 2,000 c. p. plants for the lighting of one of the principal business streets of Turin, Via Garibaldi, as well as the Place dela Castello. These lights were tried where two or three other well known European systems had failed, and it is hardly necessary to say that this system has given universal satisfaction; so much so, that the entire rights for electric lighting have been granted to the Messrs. Bellani Fratelli by the Municipality of Turin, and in view of the good action of the lights at Via Garibaldi and other places mentioned, the city authorities have just given orders to light Via Roma, which is the principal business street in Turin, with fifty 2,000 c. p. Thomson-Houston arcs. This street has been illuminated for the past year or more with 50 c. p. incandescent lights, and with very indifferent success. In addition to the 30-light plant first alluded to, and the 50-light one that is now being placed, the Messrs. Bellani have one of our 50-light 1,200 c. p. machines for store lighting, and they assure us that they expect to have from 200 to 250 of our arc lights in operation within the next four or six months, and they also propose to, and are, in fact, advertising the system largely in the whole of Italy, and propose to push the business vigorously. We have just sent them one of our engineers, a young man from the States, Mr. G. J. Helms, who came abroad last March, and for a year or a year and a half before that was the manager of the Omaha Thomson-Houston Electric Light Company. We have made an engagement for him with the Messrs. Bellani for a year, to take charge of their electrical department. The Messrs. Bellani are active, pushing people, and we have no doubt that this system will occupy an advanced position in the electrical world of Italy. We have had, I may also say, a large number of lights in operation on the streets of Milan by the Societa Generale Italiana di Elettricita of that city for nearly two years. They now have 120 2,000 c. p. lights in actual operation and 45 1,200 c. p. lights for interior use; and it is expected that their street plant will be doubled very soon. There is also at Palermo, Italy, a company known as the Societa per l'Illuminazione Elettricita, who have built a new station and have 118 of our new 1,200 c. p. lights. We have just sent them from here two 500-light alternating machines as well as an engineer, Mr. E. J. Richards, who goes to Palermo under an engagement to place and care for the apparatus they have of this system.

The Boston *Herald* of Nov. 16 says: The committee on electric lighting at Hyde Park met last evening, and took such action as will insure the immediate establishment of electric lights for the streets. The details of the award of the contract to the American Electric Manufacturing Company, who underbid the Edison and Thomson-Houston companies, have already been given. The recent delay on the part of the committee has been in regard to the sureties. The sub-committee made its report last evening, one member being in favor of accepting the sureties, another against, and the third undecided. The committee had ascertained that the sureties were good for about $70,000. A motion to reject the sureties was defeated by a vote of 11 to 10. At this point Mr. Robert Bleakie, the wealthy mill owner and a member of the commitee, arose and produced a guarantee (which was unknown to the American Company), expressing confidence in the bond, as given, and signed by himself and Messrs. B. F. Radfford, J. S. Bleakie, C. Fred Allen, S. C. Putnam, David Perkins, F. N. Tirrell, J. D. McAvoy and W. J. Stuart, all prominent and wealthy citizens of the town. This floored the opposition, and it was voted to accept the bond. The selectmen immediately executed the contract, and the American Company will be notified to day to begin at once the putting in of the plant.

The following is from the Lowell *Courier* of late date:

Wm. Hanson, lineman of the Salem Electric Light Company had a narrow escape Saturday. It was near lighting up time, and Hanson was engaged in clearing a broken limb from the wires on the main circuit. He had climbed the tree and had gone out upon a board resting upon the branches. In cutting away the impeding limb the branches upon which he was supported gave way, and he fell. In falling one wire was broken, and Hanson saved himself by catching upon the other. He hung suspended by both hands at a considerable height above the earth. It lacked but a very few minutes of the time of turning on the current, and the young man was in imminent peril of the deadly electric shock. Supt. Morrill, who had fortunately been with Hanson, reached the central station after a hard run, just as the engineer was about to turn on the lights. The action was stopped and Hanson was soon relieved from his uncomfortable position. His life was undoubtedly saved by the promptness of the superintendent.

One of the most valuable institutions to the users of steam power, remarks the Boston *Commercial Bulletin*, is the well-known Hartford Steam Boiler Inspection and Insurance Co., of Hartford. That city is pre-eminently one of insurance companies, and the above mentioned is equal to any of the life or fire companies in the measure of success it has attained during the 20 years of its existence. Mr. J. M. Allen, its president from the beginning, is the real life power of the institution. With a practical knowledge of mechanical engineering he has continually brought all his efforts to bear upon the building up of the company, and with the aid of capable subordinates has seen it grow from a capital of $100,000 in 1867 to one of $500,000, and assets of $1,000,000. The plan of the company was a novel one, but its practicability and the need of just such an institution have been amply proven. It insures steam boilers, and employs a small army of experts, who are continually on the road making careful inspections of the property to be insured, and periodical inspections of that already insured. It aims not only to insure against but to prevent loss in reducing the opportunity for boiler explosions. Expert attention is given to the construction and setting of boilers, and an important branch of its work of late years has been the furnishing of specifications for manufacturers or others contemplating setting up boilers. Blank forms are provided, which are filled in to suit the circumstances of each case, and these give the manufacturer something definite to go by in contracting for what he needs, and they all contain the stipulation that the work when completed must be submitted to the insurance company and approved by it. The company gives its valuable technical and expert assistance only to insurers. The valuable assistance which the Hartford Steam Boiler Inspection and Insurance Co. has given to manufacturers cannot be overestimated. Its office in Boston, for the Northeastern district of New England, is at 35 Pemberton Square, in charge of Mr. C. E. Roberts. W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Dec. 3, 1887.

The absorbing topic this week is the gas question. The newspapers have learned that the Gas Trust compromised a suit by paying $150,000 cash for $18,000 worth of stock, and, of course, the attacks upon the Trust have been renewed thereby. Alderman Clarke, of the City Council, having stated his preference for electricity over gas, the *Tribune* wants to know how residences can be supplied without the use of isolated plants. The editorial displays a lamentable ignorance of the state of development of electricity, while at the same time it deplores the fact (?) that the scheme is utterly impracticable. If some enterprising company would select a residence street there is no doubt but that sufficient encouragement would be extended from the start to put the plant on a paying basis and at the same time demonstrate its usefulness. A fact that I have before referred to, that has undoubtedly affected to prejudice public opinion as to the merits of the incandescent light in this city, is that in a large majority of the isolated plants in this city the lamps are run below their normal voltage and emit a reddish yellow light.

The following editorial appeared in to-day's *Tribune*: The cheapest way in which you can use gas for illuminating purposes is to employ it for the production of electric light. A fuel gas used in a gas engine would give electrical force at a rate so small compared with present charges as to distance gas for such illuminating purposes and drive it from the field.

Mr. C. J. Van Depoele's paper to be read before the Electric Club is again necessarily postponed. Mr. Van Depoele left the city to start the electric road at Jamaica, Long Island.

Recognizing the fact that Kansas City is already a great distributing point for the West and Southwest, the Electrical Supply Company, of Chicago, has realized the necessity of locating a selling agent, Mr. C. H. Cone, at that place. He is now located at Room 18, 125 West Sixth street, telephone call 146. He is prepared to give quotations on all the goods in the supply line at short notice.

With the starting of the Columbus, O., Edison Illuminating Company's plant, which occurred last Saturday, the F. S. Marr Company have brought to a successful completion what promises to be one of the largest central stations in the West. The system is entirely underground and covers a greater part of the business portion of the city. The mains and services consist of Edison tubes, while Callender cables are used for the feeders. The station building, situated on the corner of 3d and Gay streets, is a substantial brick structure, trimmed with brown sandstone, and contains offices, engine and boiler rooms. At the northeast corner of the building is an imposing chimney 125 feet high and 16 × 16 feet at the base. The internal diameter is seven feet.

In the boiler room there are at present four Root water tube boilers of 150 h. p. each built by Abendroth & Root, New York. Water is supplied by two Dean Bros.' duplex pumps, and passes first to a Berryman feed-water heater, thence through a Hopp's lime extractor to the boilers, with are set with the Murphy furnace. The engine room, which is separated by a brick wall from the boiler room, contains at present four Armington & Sims automatic engines and eight No. 20 Edison dynamos, making a total capacity of nearly 8,000 lights.

The company already have over 4,000 lights wired. Stores, halls, shops, dwellings, saloons and theatres are among the patrons of the light, which is everywhere giving unqualified satisfaction. The electrical work has had the minute supervision of the Marr Company's experts, and has necessarily been done in the most thorough manner, with a view to uninterrupted and lasting service.

The steam plant also, from the foundations to the starting of the engines, has been under the constant supervision of the Marr Company, who have brought to bear a wide experience with the best modern practice in this important branch of electrical construction. In this connection it might be proper to add that the want felt for responsible contractors, capable of constructing entire such large plants as the one just completed here, has forced the Marr Company to go into the general construction business, and I am told that they are at present engaged on no fewer than five large plants including Westinghouse stations in Massachusetts and Texas, as well as Edison installations in Chicago and at Augusta, Ga. The officers of the Columbus Company are: president, C. H. Lindenberge; secretary and general manager, Will C. Turner; treasurer, John Seibert.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes me the following quotations upon telephone stock:

Bell of Mo.	$160@$165
Central Union	44@ 45
Chicago	375@ 390
Colorado	18@ 20
Cumberland	62@ 65
Great Southern	30@ 32
Iowa Union	28@ 30
Michigan	76@ 77
Missouri and Kansas	68@ 69
Rocky Mountain Bell	40@ 45
Wisconsin	108@ 109

C. H. M.

SOUTHERN NOTES.

MACON, Ga., Nov. 7, 1887.

The Jeter & Boardman Gas and Water Association has been formed here, as recently noticed by you. Mr. W. A. Jeter has been elected president, and Mr. A. E. Boardman secretary and treasurer. The capital stock is authorized to the extent of $200,000, and $50,000 was paid in before organizing. The purpose is to build and operate gas, electric light and water works in the growing Southern cities, and insure to them properly constructed and economically managed plants. Unfortunately, many of our towns have suffered through the false representations of adventurers seeking franchises, and when granted they have not carried out their contracts in a manner at all satisfactory. The association is not wedded to any particular process of manufacturing, generating or distributing, and proposes to adopt that system which will prove best for the locality where its works are, in each case, to be erected. It is believed, however, that by combining these kindred interests in any locality many economies in constructing and operating can be secured, and thus the public can obtain such necessaries at the lowest possible price. Being composed of business men well known in the South, the association offers a guarantee of honest work and management, which, it thinks, will go far toward satisfying the authorities of the cities wherein it is proposed to operate.

AUSTIN, Tex., Nov. 17, 1887.

The Austin Water, Light and Power Company started the Westinghouse alternating system on the 14th inst. with over 600 lights in operation, and already they have orders for more than double that amount. The building is a handsome brick structure 90 × 40, with fire-room attached. The plant at present consists of two 650-light and one 1,300-light machine. They are run by Ball engines, which give entire satisfaction. The extent of the plant can be readily seen from the fact that more than 75 miles of wire is already strung. Besides the incandescent system, which is generally used for all places of business and residences, there is also in operation 88 Brush arc lights for commercial and city lighting. It is the intention to have incandescents on the outlying parts of the town, and thus dispense with the gas and gasoline burners.

All the work was done under the direct supervision of M. D. Mather, the company's able president, and shows the result of much care in every detail. It is sufficient to say that Austin has at present the "gem" plant of the Southwest. The State is fast developing for electric lights, and all agents with whom I have talked report new orders and increase of existing plants. The State Capitol is to be lit throughout, likely from the central station, though there is some talk of an isolated Westinghouse plant.

D. C. S.

PACIFIC SLOPE NOTES.

SAN FRANCISCO, Cal., Nov. 26, 1887.

The Pacific Electrical Storage Company are building a large workshop on Sixth and Townsend streets, for the building of storage batteries and motors.

The Southern Pacific Railroad Company, at Oakland, Cal., is to increase its electric lighting plant with another sixty-light dynamo, and with storage batteries for incandescent lighting. It is also to put in a plant for its docks and depot at Alameda.

Reading, Cal., is soon to be lighted by a Thomson-Houston plant.

The electric road at San Jose, to be operated under the Fisher system, will soon be complete and in running order. A franchise has been granted to H. H. Swayne & Co. for an extension of an electric road at Stockton.

The Western Union offices on this coast are being thoroughly overhauled.

All of the public parks in the city are now lighted by Brush arcs, by order of the Board of Supervisors. The action of these officers is well taken and has been loudly praised by the public, especially by those who like to enjoy an evening stroll.

The electric light plant at Alameda, sold some five months ago to the city, has not yet been taken over by the Board of Trustees.

B

THE TELEGRAPH.

T. M. B. A.—Assessment No. 12 for December, of $1, has been made, to meet the death claims of Robert E. Sperry, C. A. Holman and A. P. Reeves. There were 3,233 members in good standing on Nov. 1 in the First Division.

German Telegraphs.—A special dispatch of Dec. 1 from Berlin says: A meeting of the shareholders of the United German Telegraph Company was held to-day. The holders of 19,785 shares were present, and approved the sale of the company's lines to the government.

The Application Withdrawn.—An English banking-house cables that the London Stock Exchange grants M. Gould leave to withdraw his application to have Western Union listed. The movement to list this stock in London was one of the cardinal points in the bull movement last week.

Police Telegraphy.—The Police Commissioners of New York City are now systematically inspecting the various police telegraphs submitted for their adoption in the Nineteenth Precinct, at the Thirtieth street station-house. Among the leading inventions on trial is the Herzog teleseme.

Western Union Taxes.—The suit of Massachusetts against the Western Union Company for taxes of $10,618 on its corporate franchise has been decided by Judge Colt, of the U. S. Circuit Court, in favor of the State. It is said that the decision will probably be appealed to the U. S. Supreme Court.

Train Employes Learn Telegraphy.—The elevated railroad managers in this city have established a school for telegraphy at the Chatham square junction, in one of the rooms of the establishment at that point. It is presided over by George W. Russell, train dispatcher. Gatemen, guards and other employés, who are ignorant of telegraphy, have been invited to attend in their hours off duty.

Southern and Atlantic.—At the annual meeting of stockholders of the Southern and Atlantic Telegraph Company, an auxiliary company controlled by the Western Union, held last week, the following board of directors was chosen: Dr. Norvin Green, Thomas T. Eckert, John Van Horne, John B. Van Every, Roswell H. Rochester, Charles A. Tinker, Charles M. Fry, Henry Hentz and Arthur B. Graves. The directors will meet next Wednesday to re-elect the old officers.

A Medical Use of Train Telegraphy.—A few days since on Lehigh Valley train No. 12 a lady passenger became suddenly and seriously ill when the train was about 15 minutes west from Perth. At 4:53 P. M. the train operator dispatched a message to Dr. Shannon, of Flemington, who met the train at the Junction 5:14, and administered to the patient while the train bowled along to Easton. The train telegraph was also used successfully in providing a carriage for the sick lady on her arrival, and a locomotive to convey the doctor back to his home.—*Railroad Gazette.*

Reduction in Rates.—The Western Union Telegraph Company announces the following reductions in telegraph rates, taking effect December 1st. First: The maximum rate east of and including Montana, Utah, New Mexico and Texas reduced from $1 to 75 cents. Second: Within the section east of the Mississippi River and north of Tennessee and North Carolina the maximum rate reduced from 75 cents to 50 cents. Third: Within the section south and including Virginia and Tennessee and east of the Mississippi River the maximum rate reduced from 60 cents to 50 cents.

England and Europe.—A London cable says that England is promised cheap and quick telegraphing with the continent. The present monopoly of submarine cables expires shortly, and the British post-office has resolved to refuse all future concessions. The government will either buy out existing lines or lay new ones. The government has not to pay for anything but the actual value of the plant. The present rate to Paris of 5 cents a word will be reduced to 2 cents. The inland telegraphs do not yet pay working expenses, and whether cheap continental rates will be granted is not certain.

New Solder for Telegraph Wires.—A new and rapid method of soldering these wires has recently been introduced and is now to be generally adopted in Russia. Its principal advantage consists in the saving of time required for the work, and in the avoidance of any "scraping," which would to some extent reduce the strength of the wire. The two ends of the wire—already embraced by binding wire—are dipped into a vessel holding a considerable quanity of melted solder, upon the top of which there is sufficient powdered sal ammoniac to leave a thick layer of liquid salt. The ends of the wire pressed into this vessel are quickly joined, however dirty they may be.—*Mining Journal.*

THE TELEPHONE.

Philadelphia.—It is proposed to connect up the armories with the telephone exchange, to secure prompt service with the militia in case of riot, etc.

Victoria, Australia.—The government of the colony of Victoria is to buy the local telephone plant for $200,000, and operate it as a branch of the public service.

Austin, Tex.—The telephone system suffered on the evening of Nov. 24, owing to accidental contact with the new alternating circuits. The fire in the exchange was promptly put out by the manager, Mr. Watson.

Nova Scotia.—The Nova Scotia Telephone Company, operating the Law system, has bought out the old Bell Telephone Company in the province. It is said that the price paid was about $50,000. The new company was organized and put on its present successful footing largely by the efforts of Mr. A. A. Knudson, of this city.

The Magneto Telegraph Company has been formed recently at Washington with a capital stock of $5,000,000. It controls the patents of F. H. Brown, who dispenses entirely with chemical battery power. The system has already been noticed in our columns. The officers are: President, R. B. Donaldson; vice-president, F. H. Brown; secretary, H. J. Lauck; treasurer, W. R. Riley, who are directors with W. E. Clark, S. S. Henkle, M. G. Emery, S. Norment, B. Charlton, J. L. Barbour, M. D. Peck, W. Higgins, C. F. Norment.

Telephones in the North Woods.—W. W. Roberts and M. D. Alger, of Rome, N. Y., have secured the right of way to construct a telephone line from Moose River to Old Forge, connecting with the Fulton Chain and Big Moose Lake lines. This will be the connecting link between the wilderness and the outside world, and must prove a great advantage and convenience to those who go to the woods in the summer season. Messrs. Roberts and Alger are now in the North Woods, making preparations to build the line.

The Bell Telephone Patent Cancelled in Austria.—The efforts of the Telephone Company of Austria to get the Bell patent cancelled have at last been successful. The result of the decision of the Austrian Ministry of Commerce, and the Hungarian Ministry of Agriculture, Industry and Trade, dated Oct. 28, 1887, seems to be that all these clauses of Bell's patent which refer to the telephone are cancelled, only those referring to multiplex telegraphy being allowed to stand. Certain clauses were cancelled because the Telephone Company of Austria was able to prove prior publication, and others were cancelled because the company proved that they embodied scientific principles which, according to Austrian law, can not be the proper subject of a patent.

THE ELECTRIC LIGHT.

Caribou, Me., is to have its plant in operation in two or three weeks.

Presque Isle, Me., will soon have a plant of 230 incandescents in operation.

Laredo, Tex.—Mr. A. L. McLane is interested in the plant to be put in at Laredo.

Camden, N. J.—Mr. M. P. Osborne has the franchise for the electric lighting of Camden for five years.

Bristol, Tenn.—Mr. H. Murphy is interested in the Thomson-Houston electric light plant to be erected at Bristol.

Trenton, N. J.—Mr. Samuel K. Wilson, Trenton, N. J., is lighting his two woollen mills with 1,000 Edison lamps.

Glendale, O.—Proposals are wanted for lighting the city for five years. They should be addressed to Mr. A. M. Allen.

Goldsboro, N. C.—Negotiations for the erection of an electric light plant are being carried on by Mr. H. A. De Kay.

Carabelle, Fla.—The Tallahassee, Thomasville & Gulf Railroad Company have bought an electric light plant for their saw mills, etc.

New York City.—The Brush Electric Illuminating Company, of New York, has declared its regular quarterly dividend of 2 per cent.

Lamar, Col.—The Lamar Electric Light and Gas Company, incorporated by T. J. Matthews and others, has a capital stock of $50,000.

Lock Haven, Pa.—The Lock Haven Electric Light Company has been incorporated by S. Christ and others with a capital stock of $20,000.

Oakland, Cal.—The Oakland Electric Light and Motor Company has been incorporated by J. Gamble and others, with a capital stock of $200,000.

St. Cloud, Minn.—The St. Cloud Gas and Electric Light Company has been incorporated by D. H. Freeman and others with a capital stock of $100,000.

New Brighton, N. Y.—The Staten Island Electric Company, of New Brighton, has been incorporated by F. B. Hawley and others, with a capital stock of $10,000.

Gouverneur, N. Y.—The American Illuminating and Power Company, of Gouverneur, has been incorporated by J. E. McMaster and others, with a capital stock of $20,000.

The Grove Meter.—The Grove Electric Company was organized in Philadelphia last week with a capital of $1,000,000. The object of the company is to manufacture and lease to other companies the new Grove electric light motors.

Pittsburgh, Pa.—A special dispatch of Nov. 26, from Pittsburgh, announces that the stockholders of the Westinghouse Electric Company have ratified the recent arrangement made with the Consolidated and Thomson-Houston companies.

Paris, France.—The Rothschilds, of Paris, who are the backers of the Marcel Deprez Company, a corporation which has certain rights for the supply of the electric light in Paris, have thrown down the glove to the Paris Gas Company.—*Prog. Age.*

Beaver Falls, Pa.—The Edison plant installed in the residences of Mr. H. M. Myers and Mr. H. T. Reeves, at Beaver Falls, by Stern & Silverman, Edison agents, is pronounced a decided success. The same firm had the contract also for the fixtures, etc.

Lowville, N. Y.—The electric light company which was recently formed at Lowville, with a capital stock of $15,000, has decided to adopt the American system, and is already engaged on the work of installing the plant, which is expected to be in operation before Christmas.

The Barrett Train Lighting System.—It may not be generally known that the Barrett system, with accumulators, and with dynamo on the cars, driven by an engine taking steam from the locomotive, has been put in service on an entire train on the Connecticut River Railroad.

Train Lighting in Massachusetts.—The railroad commissioners of Massachusetts have issued a circular to the various companies, asking among other things for information as to systems of train lighting in use, including electricity, and as to accidents during the past five years from the old methods.

On Tricycles.—The electric light has been again applied to the cycles. At a recent run of the Southern Tricycle Club, Capt.

Izod rode a machine lighted by means of a small incandescent lamp, contained in an ordinary box, fitted with a bright reflector. The experiment was a success, the light being found to be extremely penetrating.

Gracewood, Ga.—The Central Georgia Land Company has been incorporated by R. M. Mitchell, W. H. F. Walker, C. V. Parks, W. F. Walker, C. A. Evans and others, with a capital stock of $3,750 and with liberty to increase to $1,000,000. The company proposes to do many things, including the construction of electric light plants.

Albia, Ia.—The city council of Albia, Ia., appointed a committee on Nov. 7, 1887, to consider a proposition made by a Mr. Emery to light the city by electricity, but nothing has been done up to the present time. Mr. T. G. Moore is the chairman of that committee. Mr. T. J. Baird is the clerk of the council. It is believed that no immediate action will be taken.

Berlin, Germany.—The General Company of Electricity of Berlin, with a fully paid-up capital of £250,000, has issued £350,000 of additional shares at a rate of 122 for 100. Forty thousand pounds' worth was taken beforehand by MM. Siemens and Halske, and the rest is subscribed for several times over, all fully paid. The purpose is the working of central stations in Germany and other countries.—*London Times.*

A Smart Letter Carrier.—One of Bridgeport's letter carriers, whose duties require him to distribute the mail over his route after dark, has adopted the novel practice of wearing an electric scarf-pin. When desirous of looking at the address of an envelope in the dark, he holds it up before his face and switches on the electricity concealed in his pocket. His scarf-pin flashes out a one-candle power electric light.—*Hartford Times.*

Stockton, Cal.—The contract for lighting the city of Stockton for two years from January 1, 1888, has been awarded to the Jenney Electric Company of Indianapolis. It is for 100 lights at $13 75 per light per month, making $16,500 yearly. There are to be 11 towers 100 feet high with not less than three lights on each and 67 lights on arm lights 50 feet feet high, with two extra lights, free, for the city hall. Stockton will be a well-lighted city.

Copper-Coated Carbons.—A meeting of carbon manufacturers was held at Cleveland last week, and a combination was formed by the companies represented, for the purpose of joining hands with the Faraday Carbon Company, of Pittsburgh, in defense of the suit brought against that company by the Brush Electric Company, in regard to the manufacture of copper-coated carbons. It is reported that all the manufacturers, outside the Brush, will "pool their issues" in this matter.

Peekskill, N. Y., has put in a Westinghouse alternating plant of over 1,000 lights. The plant was started up on Nov. 23, and is now in regular operation. Mr. G. V. B. Frost, a gentleman well known in electrical circles, is interested, with Mr. T. D. Husted, Mr. L. F. Crumb and others. The local *Blade* of Nov. 26, and *Messenger*, of Nov. 24, gave very full and interesting accounts of the inauguration. The corporation formed is known as the Peekskill Electric Light and Power Company. Street lighting with the system is also talked about.

The Thomson-Houston Carbon Factory.—The Fremont (Ohio) *Daily News* in its special Board of Trade edition gives an illustrated description of the new carbon works at Fremont of the Thomson-Houston Company. The main building is 264 by 70 feet, with engine and dynamo houses, coke-house, etc., and has a switch to the L. S. & M. S. Railway. The engine is of 200 h. p. and natural gas is used for fuel. Over 60 men are now employed under Mr. W. R. Caulkins as general manager and Mr. P. Moses as superintendent, and the force is soon to be doubled. The paper gives also a portrait of Mr. Caulkins and a view of his house.

Pittsburgh, Pa.—The Westinghouse system is to be used in lighting the fine new court house at Pittsburgh. Messrs. Stern & Silverman, agents for the Edison system for Pittsburgh territory, report business quite active. Among the plants that they are at present installing are the following: *Daily Dispatch* (Power Hall), 500 lights; Hamilton, Lemmon, Arnold & Co., Allegheny City, 50; H. M. Myers, Beaver Falls, Pa., 80; Pittsburgh *Evening Leader*, 150; Pittsburgh Plate Glass Co., Creighton, Pa., 100; Bailey, Farrell & Co., Pittsburgh, 150; Markle's paper mill, West Newton, Pa., 40.

Arc Lamp Litigation.—The Brush Electric Company has brought suit at Detroit in the United States Circuit Court, against Owen Pixley & Co., with the object of obtaining an injunction which shall prevent the further use of the Fort Wayne Jenney system, it being claimed that the latter is an infringement of the Brush patents. Gen. M. D. Leggett is conducting the case for the Brush Company, and Judge R. S. Taylor represents the Jenney Company. Lamps of the two systems are shown in operation before the court, wires being run in from the street mains. Judge Gresham is hearing the case.

Incandescent Lamp Litigation.—Suit for infringement has been brought in the U. S. Circuit Court at Baltimore against the Edison Electric Illuminating Company of Cumberland, Md., by the Consolidated Electric Light Company of this city. The suit is based on patents 210,809, 229,335, 317,876 and reissue 10,134. These affect the use of the incandescent lamp. Local counsel have been engaged, and the preliminary hearings have been had before Judge Bond. A suit somewhat similar is pending, it is understood, in this Circuit, having been brought against the Edison Company about two years ago, since when a large amount of evidence has been taken.

Oneida, N. Y.—Mr. J. W. Warner is now operating a plant, of which he is the sole owner, of 100 Thomson-Houston arcs, lighting the streets and doing a general commercial business. Up to the present time he has been using power from Hard Bros. & Co., the spring bed manufacturers, but he is now engaged in constructing his own power plant. The station will have a large brick chimney, two boilers from Thomas Kingsford, of Oswego, of 220 h. p. capacity, and 2 Westinghouse engines. He will also install a Corliss engine of large capacity. Mr. Warner is also busy putting in an alternating incandescent plant, and this will be running by Dec. 1. Altogether the record of growth and enterprise is quite a creditable one.

Jamestown, N. Y.—The plant of the Jamestown Electric Light and Power Company has just gone into operation. It is of the Thomson-Houston system, and was put in by the Messrs. E. J. F. McEvoy and G. Hoffman. It includes four incandescent dynamos of 400 16 c. p. lights each, and two arc machines of 45 lights each, driven by Armington & Sims engines. The company will be conducted under the following management: President, Chas. W. Grant; secretary and business manager, W. F. Endress; treasurer, Chas. H. Tew; general superintendent, Geo. Hoffman. The officers at the station are A. C. Anderson, first engineer; O. F. Spencer, second engineer; Frank Sweet, first fireman, and Oscar Danielson, second fireman.

Battle Creek, Mich.—The Battle Creek Electric Light Works, built eight months ago, have been gradually increased to their present capacity under the management of Messrs. S. E. Jarvis and W. A. Foote, the proprietors. The station now operates about 150 Thomson-Houston arc lights, including 65 for the streets and 80 commercial. The power plant comprises a pair of compound condensing engines and two 60-inch boilers, yielding remarkably economical results. The company recently formed to carry on the plant has already $50,000 subscribed of its $100,000 capital. The officers are S. E. Jarvis, president; H. H. Hubbard, vice-president; A. N. Foote, secretary and treasurer; W. A. Foote, general manager, and J. L. Schoolcraft, superintendent.

The Westinghouse Electric Company.—The annual meeting of the stockholders of the Westinghouse Electric Company, of Pittsburgh, was held in the offices of the company, in that city, on Friday, Nov. 25. The reports submitted to the stockholders showed that the affairs of the company were in a satisfactory condition and the outlook for the coming year is exceedingly bright. Since April 1, 80 plants have been supplied, with an aggregate of over 108,000 lights, and there are contracts in hand for almost as many more. The company now employ about 1,000 persons, and when the new buildings are completed and occupied, by Jan. 1 next, this number will be almost doubled. The earnings of the company thus far in 1887 have been in excess of 10 per cent. on the capital of $5,000,000, and are steadily increasing.

Fort Collins, Col.—A company composed of W. B. Miner, capitalist; W. B. Stewart, mechanical engineer, and E. P. Roberts, the well-known electrical engineer, and known as the Fort Collins Light, Heat and Power Company, are putting in the Western electric arc and Mather incandescent system at the above place. There will be one 40 light arc machine and one 200 light incandescent machine, with all necessary station appliances. The power will consist of one 75 h. p. Atlas automatic engine and two boilers, Worthington pump and Baragwanath heater. The building will be of brick 50 × 60 feet. The line work is being put up in excellent shape. The poles are from 80 to 100 feet, and their butts are charred by being heavily tarred and then rotated over a fire. There are no arc wires in front of buildings, and the insurance rules are generally exceeded in strictness. The plant will probably go into operation on Jan. 1.

The Long Poles Coming Down.—Those delights of the chestnut-mongers, the tall electric light towers in Union and Madison squares, will soon cease to afford opportunity for the perpetration of the snare beginning thus: "Say, they're not going to have the electric poles any longer." This time, however, it is not because they are long enough, but because they are too short. Experience has discovered the fact that the massing of the lights at the altitude in use, while it affords plenty of illumination within a given radius, leaves a great part of the parks in question in all the deeper shadow. Hence the commission having charge of the lighting of the city has decided to discontinue the use of the long poles and ordered in their stead 30 electric lamps, which will shine instead of the gas which formerly diffused its rays from as many lamp-posts of ordinary calibre. It is anticipated that the new lights will utterly dissipate the shadows which have hitherto infested the borders of the parks, and render bench spooning one of the lost arts.—*N. Y. Times.*

APPLICATIONS OF POWER.

Steubenville, O.—An electric railway is proposed for Steubenville.

Scranton, Pa.—Another of the Scranton street railway lines is being equipped with the Van Depoele system.

Rochester, N. Y.—The Rochester City & Brighton Street Railway, the Electric Motor Railway and the Boulevard Company have organized a company to run street cars by the storage electric motor system between Rochester and Charlotte, eight miles distant.

Achard Electric Brake.—Experiments with the Achard electric brake have been made on the French state railways during the last few years. An improved form has been used, the improvement consisting in the fact that the electric current is not employed directly in working the brake shoes, but is employed to form an electro-magnet in a friction apparatus which hangs in a box near the brake axle. The action of the current causes the electro magnet to be attracted by the axle which by friction sets in rotation a drum around which a chain winds. The other end of the chain is attached to the brake lever. The electric current is generated by a dynamo on the locomotive.—*Railroad Gazette.*

Jamaica, L. I.—The Jamaica & Brooklyn Road Company will blossom out this week as an electric surface railway, with mahogany finished cars, manufactured by the Pullman Palace Car Company, and lighted by incandescent lights. Arc lights stationed at intervals will brighten up the road. The company began putting up the copper wires on Aug. 15, and it has been diligently at work ever since. It took 13 tons of three-eighths inch copper wire for the six miles of the line. The poles which support it are placed on either side of the road at intervals of 100 feet. Wires are stretched across the road, in the centre of which are wooden insulators with iron hangers, each having a projecting ear. The Van Depoele system is the one used. There are four switch cars and a turn-table at each end of the route. The barns and stables of the company at Wood Haven have been converted into shops for generating the electricity, and a large boiler-house has been added. The machinery embraces a 185 horse-power Putnam engine, two 70 horse-power boilers, a 100 horse-power generator for the railroad, and a dynamo for the electric light. Each of the cars will have a 15 horse-power motor attached, and will be lighted by electricity.

PERSONALS.

Mr. T. V. Powderly, General Master Workman of the Knights of Labor, has been in New York studying up government telegraphs. The organization favors some such system.

Mr. C. W. Price, lately of the Baltimore & Ohio telegraph service, is now associated with the Daft Company, and will give special attention to Western work.

Mr. E. A. Leslie, lately identified so prominently with the the Baltimore & Ohio telegraph system, will, it is understood, hereafter devote his attention to storage battery work, in connection with the Isolated Accumulator Company, of this city.

Mr. F. Rae, who was one of the electrical experts with Count Mitkiewicz in China, was in New York last week on a visit. His talks about the celestials are most interesting. Mr. Rae is an accomplished amateur in photography and secured lots of pictures while away. He is now engaged by the Western Union on its ticker service in Chicago.

Mr. Arthur Steuart, the legal counsel of the National Electric Light Association, will read a paper before the American Institute of Electrical Engineers on Dec. 20 on revision of the patent system. The subject is one of unusual interest and importance, and has been made a special study by Mr. Steuart, who holds some very strong opinions on the subject, and is supported by a special committee of the association.

Mr. George Kennan, the Siberian traveler and writer, is to be interdicted, it seems, from re-entering the Russian Empire. This is not to be wondered at when one recalls the manner in which he has let the light in on exile life in Northern Siberia. Yet it is not quite three years since Mr. Kennan bitterly denounced in a Washington newspaper a lecturer, Mr. William J. Armstrong, who, with great force of rhetoric and illustration, had attempted to portray before a Lincoln Hall audience the inside workings of Czarism. Mr. Keenan was then in the office of the Associated Press at the Capitol. He had been in Western and Northwestern Siberia in connection with the now defunct Russian-American telegraph scheme.—*N. Y. Graphic*

Mr. John J. Moore, well known through his connection with electric lighting in this city, displayed at the St. James Hotel a few nights ago a very handsome pocket-knife with the monogram and crest of Napoleon on the handle and blade. The knife belonged to an English naval officer, whose father had received it from Napoleon during his exile at St. Helena, and as a souvenir it was prized very highly in the officer's family. By some accident one of the blades was broken, and it could not be welded together in the ordinary way without destroying the monogram and crest, so it was sent to the electrical works at Lynn, Mass., to be welded by electricity, if possible. The welding was accomplished, and so perfectly that only the faintest scar across the face of the blade is now discernible, and the crest and monogram are marred only a little.—*Commercial Advertiser.*

Count Mitkiewicz, whether still solid with the Chinese government or not, and whether a count of no account or a count of the purest lineage, is certainly whooping things up around New York when he visits this city. He lives in expensive style at the St. James Hotel, where he occupies large and costly apartments, and he throws money around in a fashion that appears to have liberally justified the title of "high roller" that is bestowed upon him by the bellboys and porters. At night the gentleman gets out and paints New York with a vigor and a florid depth of color that are quite interesting to the beholder. He insists that there is nothing the matter at all with his concessions, that he has all the money he wants, and that he will unquestionably clear several millions before he is through. The money part of it, at all events, seems to be all right. Mitkiewicz sports always a stupendous roll of bank notes with several $1,000 bills for wrappers, and he doesn't appear to care a button how he lavishes his wealth.—*New York World.*

Mr. Norman Lockyer's paper on the "Spectra of Meteorites," read before the Royal Society recently, has created a deep impression in astronomical and scientific circles. He starts with the meteorite as a cosmical unit and says the spectroscope practically demonstrates that "all self-luminous bodies in the celestial spaces are composed of meteorites, or masses of meteoric vapor, produced by heat brought about by condensation of meteor swarms due to gravity." This magnificent hypothesis entirely revolutionizes astronomical bases by sweeping away all the present distinctions between stars, comets and nebulæ, and attributing the difference in their spectra solely to variations in temperature. Mr. Lockyer has reproduced all these variations in miniature by warming a meteoric fragment placed in a vacuum tube through which an electrical discharge is passed, and has obtained all the grades of spectra, from the pale nebula to the comet in perihelion, and to a star of considerable brilliancy, solely by increasing the heat. The whole paper is of the most striking and suggestive originality, and is accepted by English scientists as laying the foundation for a new astronomy based on the spectroscope.

SPARKS AND FLASHES.

A New Sphere for Car Horses.—There is a mince pie factory in central New York which employs a hundred hands.—*Chicago Journal.* It will afford a sphere for car horses when the electric motor shall have arrived.—*N. Y. Herald.*

Mr. Gould in England.—A London financial paper in enumerating the results of Mr. Gould's visit to England, says that the post office authorities have asked for military aid to guard the telegraph wires, and the telegraph poles have been chained to the ground.

Where the Waste Goes.—"I see Edison claims that only about one-fourth of every ton of coal is utilized by the consumer."

"So? I didn't think the dealer measured it quite as short as all that."—*Chicago News.*

How to Secure Sleep.—The electricity lunatic is abroad and has dropped in at the office of the Boston *Traveler* to remark that "a good way for a person to secure sleep is to dip a fine linen handkerchief in witch hazel" (the hazel, by the way, of the true divining rod) "and bind it tightly over the eyes with a white silk handkerchief. The silk has an electric—an insulating quality

—that renders it all important." What amulets are to Arabs that is electricity to many Americans.—*Commercial Advertiser.*

Thunderbolts Free.—It is interesting to note that whatever the duty on iron may be, Secretary Fairchild holds that thunderbolts may come into the country free. The electric light folks cannot be made to pay duty on their electricity, because it has no merchantable substance. Gas in a pipe is dutiable.—*Washington Star.*

A General Alarm.—In describing the Omaha fire alarm system, the Omaha *Bee* tells the following story: "In the days of '71, when Tweed and Genet and the old crowd were kings, contractors wore diamonds, sped fast horseflesh and gave entertainments fit for Amphytrion. At a little supper given to a visiting delegation of Philadelphia firemen, the question of the promptness of the fire departments of the respective cities arose. Bets were made, of big money, too, and one of the New Yorkers turned in a general alarm from the nearest corner. It was followed by a response of all the engines in New York city. The New Yorkers won the bet, but great indignation was felt at the outrage and expense to the city, and an investigation followed. It was impossible to fasten the crime on any one, as many had keys. The prevention of a like scene led to the numbering of the various keys given out, and then came the invention of the release key for greater precaution."

Fire Alarms in Paris.—M. Sarcy, a theatre director at Paris, tells of the following occurrence, for the truth of which he vouches: All the theatres are connected by fire alarm telegraph with the nearest engine stations. One of the directors recently wished to see how quickly the "fire laddies" would arrive and sent out an alarm to the nearest station. The company responded to the call at the end of twenty minutes, when they drew up before the building. He said to the foreman, "I simply wished to see how quickly you would come; but I am certain that my theatre would be reduced to ashes if I were to wait for you, and I am going to report you." The foreman became very angry, and in order to forestall the director's report, got out a warrant, and the police judge fined the latter 300 francs for sending out a false alarm So much for meddling with the Parisian Fire Brigade.—*Fire and Water.*

MISCELLANEOUS NOTES.

Syracuse, N. Y., is investigating underground systems.

Boston Electric Club.—The following are the nominees of the club for officers during 1888: President, P. H. Alexander; Vice Presidents, 1st, W. J. Denver; 2d, Suel Smith; 3d, E. Wilbur Rice, Jr.; 4th F. Fuller; Treasurer, F. J. Boynton; Secretary, R. F. Ross; Historian, A. V. Garratt.

Philadelphia.—The comprehensive subway privileges of the Penn Electric Company in Philadelphia have been declared invalid by the city solicitor. These franchises are held by what is known as the Electrical Trust. An effort at forfeiture was made in the City Councils on Dec. 1, but was frustrated.

To Help Save Horses.—Mr. M. M. Shelley has recently brought out in this city an invention which is worked either by electricity or by hand, and which, in case of a fire, rings a bell in car stables, open the doors, unhitches the horses, and, by squirting water in their faces, drives them out of their stalls.

New York Electrical Society.—At the next meeting of the New York Electrical Society Mr. Clarence L. Healy, electrician of the Commercial Telegram Company, of this city, will give a lecture on "Stock Quotation Instruments." The lecture will be illustrated by means of the lantern, and will take place at the home of the Society, Clinton Hall, Eighth street, Dec. 14, at 8 P. M.

A Fog Concealed the Fire.—The fog was so dense in Newark at 3 o'clock on Nov. 27 that an electric light could not be seen from across the street. At this hour the waiters in an all-night restaurant smelled smoke and heard fire crackling. Looking around they found that the brick building of the Schuyler electric light station was nearly destroyed. The roof fell in before the alarm could be given, and the walls were falling before the engines got at work. The fire could not be seen a hundred yards away. The building was in the rear of Broad and Market streets, adjoining the old burying ground. The loss on building, engines and dynamos is about $3,500.

The Florida Electrical Society.—The Florida Electrical Society was organized at Jacksonville, Fla., on Nov. 23, with the following officers: B. F. Dillon, president; L. E. Spencer, first vice-president; W. R. Davis, second vice-president; G. W. Davis, of Palatka, third vice-president; J. S. Arnold, of Sanford, fourth vice-president; E. B. King, secretary; D. J. Crowley, treasurer; R. B. Rood, librarian. The objects of the society are the advancement of electrical knowledge among its members, the establishment of a library, a reading room and a laboratory, and the holding of periodical meetings at which the reading of scientific papers and their discussion are to be the leading features. The members are enthusiastic over the inauguration of the society, and Mr. Dillon is very much interested in it.—*Florida Times-Union.*

BUSINESS NOTICES.

Hine & Robertson, 45 Cortlandt street, New York, make special inducements to electric light superintendents and engineers to introduce "Eureka" packing and other specialties. It will pay to communicate with them.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Whenever you have an inquiry about electrical appliances for medical use you will *never* go astray in commending those made by Jerome Kidder & Co. Every desirable feature of electrical methods of treatment is embraced in the varieties of instruments they manufacture. They have stood the *test of* time, of medical surveillance, of public observation, and to day lead all others in merit and sale.—*Pharmaceutical Record, Nov. 1, 1887.*

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

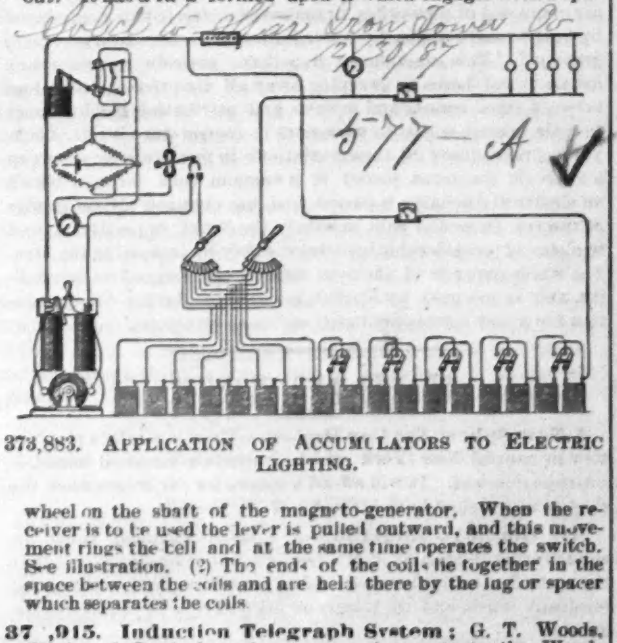
PATENTS DATED NOVEMBER 29, 1887.

373,859. Regulator for Electric Generators; R. P. Sellon and W. M. Mordey, Victoria Works, County of Surrey, England, Assignors of one-third to C. E. Webber, of same place. Application filed June 8, 1887. The generator has an exciter, in which the excitation of its own field is controlled or regulated by the energy of the main current.

373,862. Mechanical Telephone; J. P. Sunderland, Brooklyn, N. Y. Application filed Feb. 21, 1887. The line wire enters the frame of the apparatus laterally and extends across the centre of the box back of the diaphragm, and is secured to one side of the box. The binder carrying the button is a short strip secured at its inner end to the line. The length of it is such as to cause a deviation in the line, thus keeping the binder and line under tension. This construction brings the strain upon the case or box direct, instead of through the diaphragm.

373,883. Application of Accumulators to Electric Lighting; T. P. Conant, Brooklyn, N. Y., Assignor to the Electrical Accumulator Company, New York. Application filed June 20, 1887. The opposite terminals of a series of accumulator cells are connected with conductors having in circuit translating devices such as lamps. A switch is arranged for varying the number of cells in series, and an adjustable artificial resistance is located in the main conductor between the accumulator and lamps to compensate for changes in fractions of the unit variation in electro motive force effected by the operation of the switch. See illustration.

(1) 373,910. Telephone Call Box; (2) 373,948. Winding Armatures of Dynamo-Electric Machines; C. E Scribner, Chicago, Ill., Assignor to the Western Electric Manufacturing Company, of same place. Applications filed Dec. 12, 1881, and Dec. 27, 1886, respectively. (1) The lever on which the receiver is supported is adapted to slide in and out. It has a rack formed upon it which engages with a spur



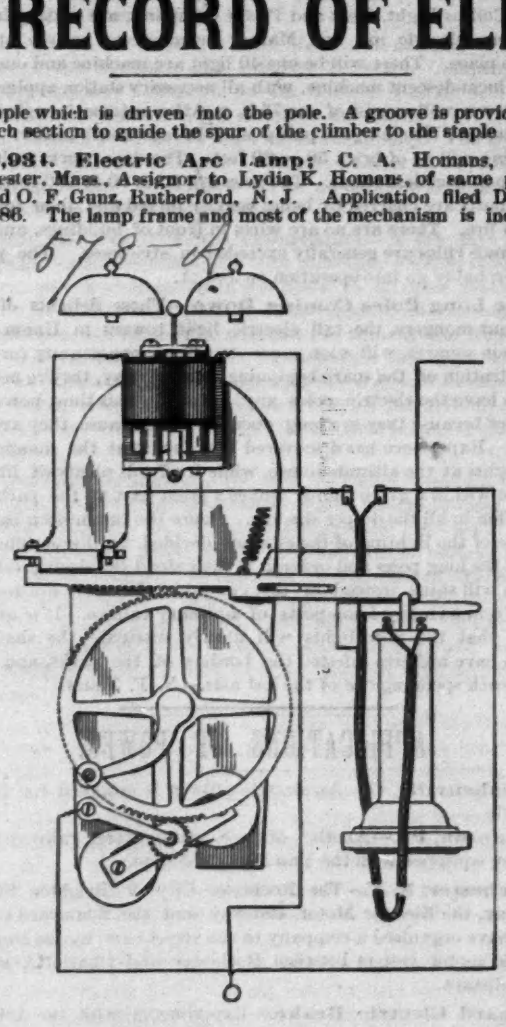
373,883. APPLICATION OF ACCUMULATORS TO ELECTRIC LIGHTING.

wheel on the shaft of the magneto-generator. When the receiver is to be used the lever is pulled outward, and this movement rings the bell and at the same time operates the switch. See illustration. (2) The ends of the coils lie together in the space between the coils and are held there by the lug or spacer which separates the coils.

373,915. Induction Telegraph System; G. T. Woods, Cincinnati, O., Assignor by mesne assignments to the Woods Electric Company. Application filed May 21, 1885. The scope and character of this invention is set forth in the second claim of the patent as follows: In a system of communication an insulated helix extending at each side of the path of the moving vehicle and forming a continuous metallic circuit in combination with suitable apparatus at the fixed station for transmitting and receiving signals by means of induction to or from the vehicle moving in inductive proximity to said conducting helix.

373,925. Telegraph Pole Protector; H. P. Cooeland, East Orange, N. J., Assignor the Western Electric Company, Chicago, Ill. This invention is designed to prevent damage to the pole caused by the spurs of linemen It consists of sectional strips placed end to end, and secured each at the centre by a staple which is driven into the pole. A groove is provided in each section to guide the spur of the climber to the staple

373,934. Electric Arc Lamp; C. A. Homans, Winchester, Mass., Assignor to Lydia K. Homans, of same place, and O. F. Gunz, Rutherford, N. J. Application filed Dec. 9, 1886. The lamp frame and most of the mechanism is inclosed



373,910. TELEPHONE CALL BOX.

in a glass globe which is closed at the top by a cover which carries the box containing the carbon regulating device. The object is to simplify the general construction of the lamp and to facilitate taking it apart.

(1) 373,967. (2) 373,968. Telegraphy; P. B. Delany, New York, N. Y., Applications filed March 17 and June 21, 1887, respectively. These inventions embrace a Morse key and apparatus for throwing working impulses of electricity of equal duration and alternating polarity upon the main line in response to the manipulation of the key. A polarized relay at a distant station receives the dots and dashes. See illustration.

373,971. Commutator Connection for Dynamo-Electric Machines; James W. Easton, New York, N. Y. Application filed April 13, 1886. The invention consists in providing a yielding or flexible coupling which extends between each end of each bobbin and the corresponding commutator plate, and which may be placed in position to connect the parts after the bobbin and plates are mounted. The connection consists of a coil spring which, by being compressed, may be slipped over a projection upon the commutator plate and the corresponding end of the wire of the armature bobbin.

373,975. Electrical Horometer; B. M. Hammond, of San Antonio, Texas. Application filed March 11, 1887. A switch in the shape of a bell crank lever is arranged with a pawl at one end, which is adapted to engage with a ratchet wheel controlling a clockwork. When the current is being used, that is, when the switch is "on," the pawl is out of engagement with the ratchet wheel, and the clockwork moves, the length of time being indicated on dials, the pointers of which are controlled by the clockwork. When the switch is "off" the pawl engages the ratchet and prevents movement of the clockwork.

374,013. Electrical Indicator for Weighing Scales; J. E. Tarbox, Lynn, Mass. Application filed Jan. 22, 1887. This apparatus includes two circuit closers, one being closed when full weight is placed on the scale, and the other when more than full weight is so placed. When the former is closed the bell gives a single stroke. But with an overweight the bell rings continuously.

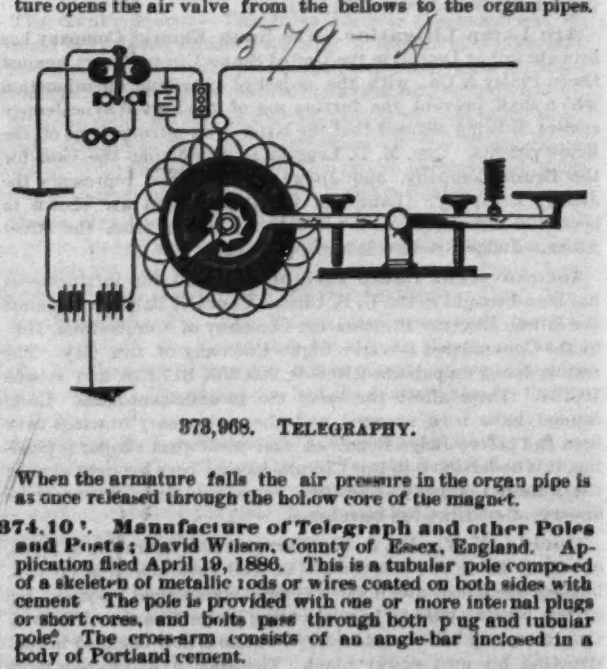
374,017. Automatic Circuit Opener; J. P. Tirrell, Somerville, Mass., Assignor to the Electric Gas Light Company, of Portland, Me. Application filed Jan. 31, 1887. In gas lighting apparatus in buildings it is customary to group the burners into sections, all of which branch from the same battery. The invention is an instrument for automatically opening the circuit of one of the sections when, by accident or otherwise, one of the other sections becomes grounded or the circuit closed. This is done before the battery has time to become exhausted.

374,028. Electric Door Opener; A. C. Woehrle, New York, N. Y. Application filed Oct. 1, 1886. The mechanism for opening the door and the electro-magnets are combined with an interposed circuit breaker acted upon by the armature, whereby the act of energizing the magnets also breaks the circuit.

374,036. Circuit Closer; C. B. Bosworth, Everett, Mass., Assignor to the Electric Gas Lighting Co., of Portland, Me. Application filed Aug. 23, 1886. An improved arrangement of contact springs and push buttons.

374,072. Electric Temperature-Regulator; W. S. Johnson, Milwaukee, Wis., Assignor to the Johnson Electric Service Company, of same place. Application filed July 16, 1886. This device is used in systems where fluid pressure operates dampers or drafts. The apparatus consists in improvements in the mechanical details through which the fluid acts on the damper.

374,088. Electric Organ Action; H. L. Roosevelt, New York, Alfred Roosevelt, Executor. Filed Sept. 28, 1886 This consists of a magnet having a hollow core with a flat valve seat at its lower end. The armature is ground to a surface at its upper and lower ends, and nominally rests on a valve seat, so as to stop the air from the bellows. When energized the armature opens the air valve from the bellows to the organ pipes.



373,968. TELEGRAPHY.

When the armature falls the air pressure in the organ pipe is at once released through the hollow core of the magnet.

374,107. Manufacture of Telegraph and other Poles and Posts; David Wilson, County of Essex, England. Application filed April 19, 1886. This is a tubular pole composed of a skeleton of metallic rods or wires coated on both sides with cement The pole is provided with one or more internal plugs or short cores, and bolts pass through both plug and tubular pole. The cross-arm consists of an angle-bar inclosed in a body of Portland cement.

374,129. Arc Light; C. B. Noble, Cleveland, O. Application filed July 12, 1887. For description see THE ELECTRICAL WORLD for Dec. 3, 1887.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.